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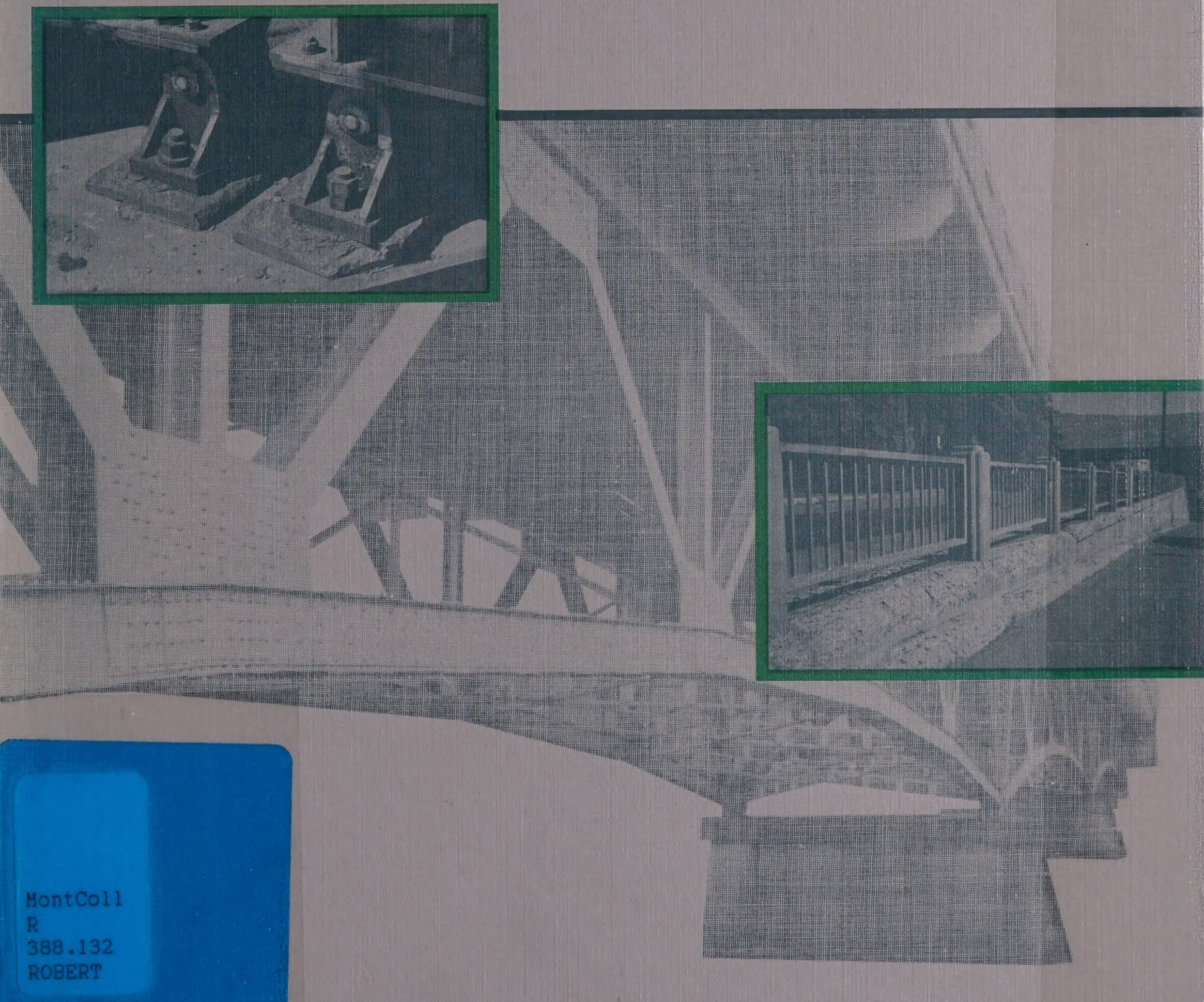
BRIDGE NEEDS STUDY



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Bridge Needs Study
Missoula, Montana

Prepared for
Missoula Office of Community Development

in Cooperation with the
Montana Department of Highways
Planning and Statistics Bureau

and the
Department of Transportation
Federal Highways Administration

Prepared by
Robert Peccia and Associates
Helena, Montana
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Missoula, Montana

Adopted January 24,1990
Missoula Technical Advisory Committee

This document reflects the views of Robert Peccia & Associates and Stensatter Druyvestein & Associates, who are responsible for the accuracy of the data presented in this study. The contents do not necessarily reflect the official views of the Federal Highway Administration or the Montana Department of Highways.

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Table of Contents

Page No.

Chapter I: Introduction

A. Project Purpose and Goals 1
B. Project Study Area 1

Chapter II: Summary of Recommended Improvements and Implementation

A. General 3
B. Summary of Recommended Improvements 3
C. Project Implementation 6

Chapter III: Funding Options

A. General 8
B. Traditional Funding Sources 8
C. Funding Options 12

Chapter IV: Study Methodology

A. Data Collection 14
B. Structural Evaluation 14
C. Operational Analysis 14
D. Development of Alternatives 15
E. Identify Recommended Improvements 15

Chapter V: Individual Site Analysis

Site 1 - Madison Street River Bridge 16
Site 2 - Higgins Avenue River Bridge 25
Site 3 - Orange Street Old Milwaukee Overpass 31
Site 4 - Orange Street River Bridge 35
Site 5 - Orange Street Montana Rail Link Underpass 44
Site 6 - Russell Street Railroad Underpass 52
Site 7 - Russell Street River Bridge 58
Site 8 - Reserve Street Overpass at West Broadway 64

List of Figures

No. Title Page No.

1 Site Location Map 2
2 Conceptual Layout - Madison St. River Bridge 19
3 Intersection of 6th and Arthur 20
4 Intersection of Madison and Broadway 21
5 Alternatives Considered - Madison St. River Bridge 23
6 Plan View - Higgins Ave. River Bridge 28
7 Alternatives Considered - Higgins Ave. River Bridge 29
8 Plan View - Orange St. Old Milwaukee Overpass 34
9 Conceptual Layout - Orange St. River Bridge 38
10 Profile View - Orange St. River Bridge 39
11 Intersection of Orange, Front, and Main 39
12 Intersection of 3rd and Orange 40
13 Proposed Typical Section - Orange St. River Bridge 42
14 Alternatives Considered - Orange St. Underpass 47
15 Conceptual Layout - Orange St. Underpass 49
16 Proposed Typical Section - Orange St. Underpass 50
17 Conceptual Layout - Russell St. Underpass 55
18 Proposed Typical Section - Russell St. Underpass 56
19 Intersection of 3rd and Russell 56
20 Conceptual Layout - Russell St. River Bridge 61
21 Intersection of Russell and Broadway 62
22 Proposed Typical Section - Russell St. River Bridge 62
23 Conceptual Layout - Reserve St. Overpass 67
24 Proposed Typical Section - Reserve St. Overpass 68

List of Photo Plates

No. Title Page No.

1 Madison St. River Bridge 17
2 Higgins Ave. River Bridge 26
3 Orange St. Old Milwaukee Overpass 32
4 Orange St. River Bridge 36
5 Orange St. Montana Rail Link Underpass 45
6 Russell St. Railroad Underpass 53
7 Russell St. River Bridge 59
8 Reserve St. Overpass 65

List of Tables

No. Title Page No.

1 Table No. 1 - Repair & Maintenance Improvements 7
2 Table No. 2 - Major Improvements 7
3 Table No. 3 - Improvement Cost Summary 7
4 Table No. 4 - Estimated Funding Levels 10

Chapter I - Introduction

Chapter I: Introduction

A. Project Purpose and Goals

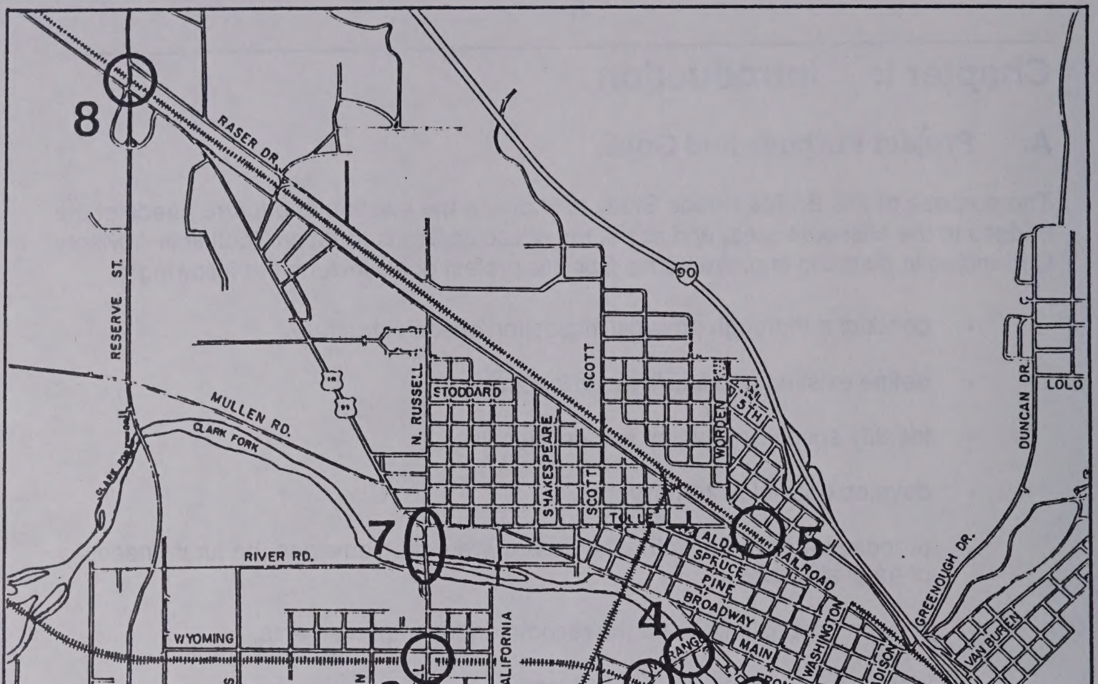
The purpose of this Bridge Needs Study is to define the existing and future needs of the bridges in the Missoula area, and assist the Missoula Transportation Technical Advisory Committee in planning improvements. Specific project goals include the following:

- conduct a thorough physical inspection of each structure,
- define existing and future traffic loadings,
- identify specific problems and deficiencies,
- develop possible alternatives,
- propose improvements that address current problems and the future needs of each structure,
- provide cost estimates for the recommended improvements,
- identify feasible funding options, and
- prioritize the recommended improvements based on the impact on the transportation system, improvement costs, and ease of implementation.

B. Project Study Area

The focus of this study is on eight bridge structures in the Missoula area. The bridges evaluated in this study are listed below and shown on Figure 1:

1. Madison Street River Bridge
2. Higgins Avenue River Bridge
3. Orange Street Old Milwaukee Overpass
4. Orange Street River Bridge
5. Orange Street Montana Rail Link Underpass
6. Russell Street Railroad Underpass
7. Russell Street River Bridge
8. Reserve Street Overpass at West Broadway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RESERVE ST.
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CLARK FORK
N. RUSSELL
STODDARD
SHAKESPEARE
SCOTT
WORDEN
5TH
7
RIVER RD.
TOLE
ALDER
RAILROAD
5
SPRUCE
PINE
BROADWAY
4
ORANGE
MAIN
FRONT
WASHINGTON
MADISON
GREENOUGH DR.
VAN BUREN
DUNCAN DR.
LOLO
WYOMING
CURTIS
CATLIN
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RUSSELL
CALIFORNIA
3
HIGGINS
2
1
4TH
5TH
6TH
WALNUT
EDDY AVE
UNIVERSITY OF MONTANA
KEMP
BECKWITH ST.
STEPHENS AVE.
PLYMOUTH ST.
BECKWITH AVE.
14TH W.
MOUNT AVE
NORTH AVE.
JOHNSON
SOUTH
FIELD
WASHBURN
STEPHENS
PARK
KENT AVE
SOUTH AVE.
RONALD
ARTHUR
MAURICE

1. **Madison Street River Bridge**
2. **Higgins Avenue River Bridge**
3. **Orange Street Old Milwaukee Overpass**
4. **Orange Street River Bridge**
5. **Orange Street Montana Rail Link Underpass**
6. **Russell Street Railroad Underpass**
7. **Russell Street River Bridge**
8. **Reserve Street Overpass at West Broadway**

Figure 1
Site Location Map

Chapter II - Summary of Recommended Improvements and Implementation

Chapter II: Summary of Recommended Improvements and Implementation

A. General

This study involved an evaluation of the operational and structural adequacy of each bridge. This evaluation resulted in the identification of current and future needs. A series of improvements have been developed to address these needs. The recommended improvements are summarized in this chapter. A more detailed explanation of each improvement is contained in Chapter V of this report.

The improvements have also been prioritized based on the structural or operational need for the improvement, estimated cost, coordination with other projects, and ease of implementation.

B. Summary of Recommended Improvements

Madison St. River Bridge

This 4-lane bridge was built in 1958 and had a partial deck replacement in 1983. It is currently in good condition, but needs some repair and maintenance. The bridge will handle the projected traffic through the year 2010. Modifications to the south approach and the Madison/Broadway intersection are recommended to improve the operation of the Madison Street corridor. Additional right-of-way will be required. Improvements to the pedestrian/bicycle facilities on the south side of the bridge are also recommended.

Recommended Improvements	Estimated Cost
1. Repair and maintenance of existing bridge	$275,000
2. Major rehabilitation of existing bridge	$890,000
3. Realign the south approach to the bridge	$590,000
4. Modify the intersection of Madison and Broadway	$245,000
5. Construct a pedestrian/bicyclist trail along the south approach	$25,000
TOTAL:	$2,025,000

Higgins Avenue River Bridge

This 4-lane bridge was constructed in 1962 and had a partial deck replacement in 1983. The bridge is currently in fair condition, but it needs repair and heavy maintenance. The bridge will handle the projected traffic through the year 2010. The existing bridge approaches and the adjacent intersections are also expected to function adequately through the year 2010 without any major modifications or reconstruction.

Recommended Improvements	Estimated Cost
1. Repair and maintenance of existing bridge	$465,000
2. Major rehabilitation of existing bridge	$980,000
TOTAL:	$1,445,000

Orange Street Old Milwaukee Overpass

The Old Milwaukee overpass was built in 1936. The structure is no longer required since the railroad was removed several years ago.The overpass should be removed. Timing of this project should be coordinated with the widening of Orange Street south of the river, and the widening of the Orange Street river bridge.

Recommended Improvements	Estimated Cost
1. Remove overpass	$370,000
TOTAL:	$370,000

Orange Street River Bridge

The Orange Street bridge is a 2-lane structure that was built in 1937. It is currently in fair condition, but needs repair and heavy maintenance. This bridge should be widened to 4-lanes as soon as funds are available. The widening should be accomplished by rehabilitating the existing bridge and adding a new 2-lane structure on the upstream side. Additional right-of-way will be required.

Recommended Improvements	Estimated Cost
1. Repair and maintenance of existing bridge	$135,000
2. Widen bridge to four lanes	$4,200,000
TOTAL:	$4,335,000

Orange Street Montana Rail Link Underpass

The Orange Street underpass was constructed in 1939 and consists of 15 separate structures. The underpass is currently in poor condition and is in need of repair and heavy maintenance. The underpass should be widened to 4-lanes as soon as funds are available. This will require purchasing and removing two buildings and closing two city streets.

Recommended Improvements	Estimated Cost
1. Phase I - Remove excess structure	$650,000
2. Phase II - Construct new 4-lane underpass	$3,600,000
TOTAL:	$4,250,000

Russell Street Railroad Underpass

The Russell Street underpass consists of three separate structures, one for an access road and the other two for a pair of railroad siding tracks. The railroad crossing is no longer needed and the State is arranging to acquire the right-of-way. The access road is seldom used and carries local traffic only. These underpass structures are not necessary and should be removed as soon as funds are available.

Recommended Improvements	Estimated Cost
1. Remove underpass	$240,000
TOTAL:	$240,000

Russell Street River Bridge

This 2-lane bridge was built in 1957 and has recently had an asphalt overlay. The overall condition of this bridge is fair, but it does have some deficiencies that should be corrected through a repair and maintenance project. The capacity analysis of the major intersections on the Russell Street corridor indicates that the roadway and the bridge should be widened to 4-lanes as soon as funds are available. This widening should be accomplished by rehabilitating the existing structure and adding a new 2-lane bridge next to the existing one. Additional right-of-way will be required. The widening of the bridge will allow for needed modifications to the intersection of Russell and Broadway, which are also recommended.

Recommended Improvements	Estimated Cost
1. Repair and maintenance of existing bridge	$100,000
2. Widen bridge to four lanes	$3,170,000
3. Modify intersection of Russell and Broadway	$40,000
TOTAL:	$3,310,000

Reserve Street Overpass at West Broadway

This overpass was built in 1968. The deck received an asphalt overlay in 1987. The current condition of the structure is fair, although it needs some repair and heavy maintenance. The overpass should be widened to 4-lanes when the rest of the Reserve Street corridor is widened. This widening should be accomplished by rehabilitating the existing structure and adding a new 2-lane bridge next to the existing one. The widening should be coordinated with the widening of the adjacent roadway. The existing structure will require a partial, and perhaps a complete, deck replacement at that time.

Recommended Improvements	Estimated Cost
1. Repair and maintenance of existing overpass	$100,000
2. Widen overpass to four lanes	$2,900,000
TOTAL:	$3,000,000
Grand Total:	**$20,290,000**

C. Project Implementation

The recommended improvements address the bridge needs of the eight structures evaluated in this study. It is desirable to implement all of the recommended improvements within the next 20 years. Unfortunately, the cost of these improvements outweigh the funds available from present sources.

Realizing that current funding is inadequate to cover the cost of repairing and upgrading these structures, it is necessary to prioritize the improvement projects so the funds invested will result in the most benefits to the transportation system.

The projects have been grouped into two categories; repair and maintenance improvements, and major improvements. The improvement projects have been arranged within the two categories according to the recommended order of implementation.

The repair and maintenance improvements shown in Table No. 1 include projects that should be done as soon as possible. These include repairs that are necessary to prevent the deterioration of a structure and projects that are considered essential to the operation of the transportation system. It is desirable to implement these short-term improvements as soon as funding is available. Detailed descriptions of the recommended improvements are contained in Chapter V.

The major improvements shown in Table No. 2 include projects that address the future traffic demands and projects that will not be required within the next 10 years.

Note that two non-bridge improvements discussed in section B of this chapter are not shown in these two tables. These projects included modifying the Madison/Broadway intersection and realigning the south bridge approach to the Madison River bridge ($615,000).

Table No. 3 shows a breakdown of the improvement costs for each structure by improvement type.

Table No. 1
Repair and Maintenance Improvements

Priority Ranking	Project Description	Estimated Cost
1.	Russell St. Underpass - Remove Structure	$240,000
2.	Madison St. Bridge - Repair & Maintenance	$275,000
3.	Orange St. Bridge - Repair & Maintenance	$135,000
4.	Orange St. Underpass - Phase I - Remove Excess Structure	$650,000
5.	Russell St. Bridge - Repair & Maintenance	$100,000
6.	Reserve St. Overpass - Repair & Maintenance	$100,000
7.	Higgins Ave. Bridge - Repair & Maintenance	$465,000
8.	Orange St. Overpass - Remove Structure	$370,000
	TOTAL COST:	**2,335,000**

Table No. 2
Major Improvements

Priority Ranking	Project Description	Estimated Cost
1.	Orange St. Bridge - Widen to 4-Lanes & Improve Ped/Bike Facilities	$4,230,000
2.	Russell St. Bridge - Widen to 4-Lanes & Modify Russell/Broadway Intersection	$3,210,000
3.	Orange St. Underpass - Phase II - Widen to 4-Lanes	$3,600,000
4.	Madison St. Bridge - Major Rehabilitation	$890,000
5.	Higgins Ave. Bridge - Major Rehabilitation	$980,000
6.	Reserve St. Overpass - Widen to 4-Lanes	$2,900,000
	TOTAL COST:	**$15,810,000**

Table No. 3
Improvement Cost Summary

Location	Repair & Maint.	Major Rehab.	Remove Structure	Widen to 4-Lane	Realign Approach	Bike/Ped. Work	Modify Intersec.	Total
Madison St. Bridge	$275,000	$890,000			$590,000	$25,000	$245,000	$2,025,000
Higgins St. Bridge	$465,000	$980,000						$1,445,000
Orange St. Bridge	$135,000	$1,055,000		$2,210,000	$935,000			$4,335,000
Orange St. Under.	$650,000			$3,600,000				$4,250,000
Orange St. Over.			$370,000					$370,000
Russell St. Bridge	$100,000	$770,000		$1,810,000	$590,000		$40,000	$3,310,000
Russell St. Under.			$240,000					$240,000
Reserve St. Over.	$100,000	$750,000		$1,500,000	$650,000			$3,000,000
TOTAL COST:	**$1,725,000**	**$4,445,000**	**$610,000**	**$9,120,000**	**$2,765,000**	**$25,000**	**$285,000**	**$18,975,000**

Chapter III - Funding Options

Chapter III: Funding Options

A. General

The improvements that were summarized in the previous chapter address the bridge needs in the Missoula area. These improvements should be implemented over the next 20 years and will cost in excess of $20 million.

The cost of repairing, rehabilitating and expanding these bridges represents a serious financial problem.

Traditionally, the majority of the financing needed to make highway and bridge improvements has come from federally funded programs. In recent years there have been significant reductions in the amount of Federal funds that are available for these types of improvements. This fact has resulted in an increased financial burden on the state and local governments.

This chapter discusses the funding sources that are traditionally used for highway improvements and some financial options that could be implemented to help pay for some of the needed improvements.

B. Traditional Funding Sources

The federal, state, city, and county governments all have current funding mechanisms that provide the resources to maintain and upgrade the highway and bridge facilities within their respective jurisdictions.

1. Federal

The Surface Transportation and Uniform Relocation Assistance Act of 1987 defines the amount of financial assistance that will be available to each state through the various Federal Aid Highway Programs. The resources for these programs come from the Highway Trust Fund which is supported by highway user fees.

It is important to realize that the current federal highway bill will expire in September of 1991. At that time Congress is expected to make major changes in the programs. It is impossible to tell how these changes will affect Montana.

For the purposes of this study it was assumed that all current federal programs will remain in effect, at current funding levels, through the year 2010.

The following federal programs could be used to finance the needed bridge improvements:

a. Primary System

This program provides funds for improvements to roadways on the Federal Aid Primary (F.A.P.) system. These funds are apportioned to the state, where they are matched with state funds at the established matching ratio and allocated to the five financial districts in the state. Project priorities are set by the Department of Highways.

b. Urban System

The Federal Aid Urban (F.A.U.) program funding is similar to the primary system except it is used exclusively on Federal Aid Urban routes.These funds are allocated to the 15 urban areas in the state based on urban area population figures. The project priorities are set by the Missoula Policy Coordinating Committee.

c. Highway Bridge Rehabilitation and Replacement Program

Financing is available through this program for rehabilitating and replacing highway bridges. The program is financed with federal and state matching funds. The Department of Highways establishes the project priorities based on a sufficiency rating system.

Table No. 4 shows the estimated funding levels for the Federal Aid Primary and Urban programs that are annually allocated for use in the Missoula area. A funding projection is also shown in the table. These projections are based on funding levels remaining constant for the next 20 years. The primary funds shown represent the amount allocated to Financial District No.1, which includes nine western Montana counties. Only a portion of this amount will be used in Missoula County.

Much of the funding shown in Table No. 4 is already committed, or scheduled to be committed, to other projects. The Department of Highways currently has planned obligations, through Federal Fiscal Year 1997, of $125 million on the F.A.P. system and $7 million on the F.A.U. system.

Table No. 4
Estimated Funding Levels for the Federal Aid Highway Programs[*]

	Primary System (FD No.1)	Urban System (Missoula)
Anticipated Unobligated Balance at end of FY 90	$ 400,000	$3,153,000
Projected Allocation For Years 1991 - 2010	$19,400,000/Yr. x 19 Yrs. $368,600,000	$697,000/Yr. x 19 Yrs. $13,243,000
Total Funds Available Through the Year 2010	$369,000,000[**]	$16,396,000

[*] Financial information from Ray Anderson, Manager of the Fiscal Programming Unit of the Program Development Division, and Bill Cloud, Urban Planning Section Supervisor, Planning and Statistics Bureau, MDOH.

[**] The portion of these funds available for use in the Missoula area is uncertain. Missoula County is one of nine counties that receive primary funds through Funding District No.1.

2. State

A portion of Montana's gas tax is utilized to fund the Reconstruction Trust Fund (RTF). This funding category is generally utilized on the rural primary system. It is unlikely that any of the bridge improvement projects identified in this report would be eligible under the RTF program.

In addition to the RTF program, a portion of the state fuel tax goes toward road maintenance funds, which are divided between the state, cities and counties according to a formula established by the Legislature. These funds can only be used for labor and material costs involved in highway reconstruction and maintenance. The majority of these funds are typically used for highway maintenance.

3. Local

The city and county have a variety of funding programs that have been designed to serve a specific function. Unfortunately, only a few of these programs can be used to fund bridge improvements.

The following local programs are considered possible funding sources:

a. City Of Missoula

1) General Fund

Most of the major city functions are financed through this fund. Revenue for this fund is generated by a general fund levy, local fees and permits, and intergovernmental fund transfers. Approximately $12.87 million has been budgeted in FY 90 for the general fund. Historically some of these funds have been used to finance road maintenance type projects. It is possible that some portions of the bridge improvement projects could be financed through this fund.

2) Capital Improvements Fund

The revenue for this fund comes from user-fees and fund transfers (typically from the general fund). This fund has traditionally been used to finance major equipment purchases and repair of non-highway facilities. Although the bridge improvements are technically eligible for financing through this fund, it is unlikely that the city would use it for that purpose.

3) Missoula Redevelopment Agency (MRA)

The MRA is financed through tax increment financing in the CBD. The MRA has provided funding for various street and parking improvements within the downtown area. The MRA is a possible source of funding for some portions of the recommended improvements, such as improving or constructing pedestrian and bicycle facilities.

4) Gas Tax Fund

The city receives approximately $550,000 annually from state gas tax revenue. This money can only be spent on labor and materials involved in street construction and maintenance projects. This fund could be used to finance portions of some of the bridge improvements.

b. Missoula County

1) County Road Fund

The road fund is financed through a county (only) mill levy of 13.83 mills which generates approximately $2.5 million annually. The ceiling limit for this fund is 15 mills. The fund also receives money from the state fuel tax, licence fees, and from non-tax revenue. The only improvements that could possibly be financed through the county road fund are projects located outside of the city limits. The Russell Street underpass and the south Approach to the Russell Street river bridge are the only study areas that are outside the city limits.

2) County Bridge Fund

This fund provides for the maintenance and replacement of county bridges and roadway culverts. The Bridge Fund receives approximately $700,000 annually from a county mill levy of 4 mills, which is the maximum allowed by law. Historically, the County has used this fund to finance bridge maintenance work and to replace three or four minor structures each year. It is unlikely that this fund could be used to implement any of the recommended bridge improvements.

C. Funding Options

This report has documented the need for over $20 million in bridge improvements. The Missoula Urban Transportation Plan Update, which was produced in 1987, identified approximately $80 million worth of needed improvements to the urban transportation study area. Some of the improvements listed in this bridge study were also mentioned in the Missoula Urban Transportation Plan Update.

It is obvious that the current funding mechanisms will not be able to meet the financial needs of the Missoula area. New funding sources will have to be developed. Several possible funding alternatives are discussed.

1. Local Option Gas Tax

A two cent per gallon local gas tax can by established county-wide upon approval of the voters. Such a tax would generate approximately $600,000 annually. These funds could be used to finance most of the recommended bridge improvements.

2. General Obligation Bond Sale

General obligation bonds could be sold to finance any specific set of highway or bridge improvements. The limits of the general obligation bond sale could be established on a county-wide or city-wide basis. The sale of these bonds requires approval by the voters that live within the affected area of the bond sale. The advantage of using obligation bonds is that when the set of improvements are completed and the bonds are retired, the obligation of the taxpayer is also retired.

3. Development Fees

Development fees are being used around the country to finance major infrastructure improvements required by private development. These fees could be used to finance certain bridge expansion projects that are required to meet the demands of increased traffic.

4. Toll Bridges

Although it is not a popular method of generating needed revenue in Montana, toll roads and bridges are used in many areas of the country. Tolls are usually project specific and only affect the users. Unfortunately, toll systems are so unpopular in this area that it is doubtful whether this form of financing can be successfully implemented in Montana. It should also be noted that the traffic volumes experienced on the bridges in Missoula will only generate enough revenue from a toll to partially finance a major improvement project.

5. Route Reclassification

Of the eight structures included in this study, the Madison Street bridge is the only one on the Federal Aid Primary system. The other seven are on Federal Aid Urban routes. It would be financially beneficial to the Missoula area to have one of the existing urban routes reassigned to the primary system.

One possible scenario would involve reassigning Reserve Street to the primary system. In exchange West Broadway, which is currently a primary route, would be switched to the urban system. This modification would have several benefits. A portion of the cost for the Reserve Street widening project, which is scheduled to begin in 1991, could be financed with primary funds. This would free up a similar amount of urban funds for use on one of the other urban routes. The switch would also place the Reserve Street overpass on the primary system, which will help reduce the financial burden on the urban system.

Chapter IV - Study Methodology

Chapter IV: Study Methodology

A. Data Collection

Information relating to each structure was obtained during the initial phase of the study. The Montana Department of Highways supplied much of this information including design and construction plans, load rating analyses, maintenance records, and inspection reports.

Highway right-of-way data was obtained from the Department of Highways in Helena and supplemented by reviewing property ownership records on file in the Missoula County Courthouse.

Historic and current traffic volume data was obtained from the Missoula Area Traffic Counting Program records. Intersection turning movement counts were performed by the consultant at pertinent signalized and unsignalized intersections within the study area. The Missoula Urban Transportation Plan Update was used as a source document for information concerning the transportation system.

Future development plans and improvements were identified through discussions with the engineers and planners for the City, County, Department of Highways, Missoula Redevelopment Agency, Montana Rail Link, and the University of Montana.

B. Structural Evaluation

A complete structural inspection and evaluation was performed on each bridge included in the study. This was done to assess the current condition of each structure and to identify needed improvements.

The Montana Department of Highways assisted in this effort by providing a "Snooper" truck, driver, and operator. The inspections were performed by structural engineers from the engineering firm of Stensatter-Druyvestein & Associates of Missoula.

Existing information on the structures such as design plans, load rating calculations, and maintenance records were reviewed. This information was used in combination with the inspection results to estimate the condition of each structure.

C. Operational Analysis

The operational analysis involved defining the current and future traffic volumes for the major roads at each site and comparing those volumes to the roadway capacity.

Traffic projections were developed using the Department of Highway's computerized traffic assignment model. This is the model that was used in the 1985 Update of the Missoula Transportation Plan. This model uses traffic generation parameters such as population and employment combined with projections of future socioeconomic conditions to estimate future traffic volumes on the major street network.

The methods outlined in the 1985 Highway Capacity Manual were used to determine the capacity and level of service of the road segments and intersections included in the analysis.

The operational analysis was used to determine the future size requirements for the structures, approaches, and adjacent intersections.

D. Development of Alternatives

The deficiencies of each structure with respect to its ability to meet future traffic requirements were identified in the previous work item. Alternatives that address these deficiencies were identified and evaluated during this phase of the study.

The AASHTO Standard Specifications for Highway Bridges, ASHTO Policy on Geometric Design of Highways and Streets, and the AASHTO Guide for Development of New Bicycle Facilities were used as a guide in the development of the alternatives.

Alternatives were developed for each site that include possible roadway cross-sections that have adequate space to handle the projected traffic volumes and meet current design standards. The space requirements for pedestrian and bicyclist traffic were also considered in the development of each alternative.

E. Identify Recommended Improvements

A set of recommended improvements were identified that address both the short- and long-term needs of each structure.

The major maintenance items and repairs that are considered essential to prolonging the service life of the structures were identified separately and recommended to be accomplished in the near future.

The major modifications that are necessary for each structure to meet current or future traffic demands were also identified. These improvements have been classified as long-term and should be implemented at the time the expansion project becomes necessary.

Cost estimates were developed for each of the recommended improvements. These estimates were based on current bridge and highway construction costs in Montana. The estimates include the cost of right-of-way acquisition and 15% for engineering. Detailed cost estimate information is on file at the Missoula Office of Community Development.

Chapter V - Individual Site Analysis

Chapter V: Individual Site Analysis

SITE 1 - MADISON STREET RIVER BRIDGE

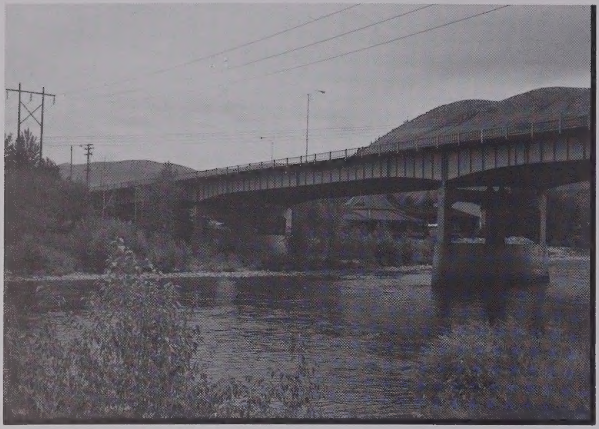
A. General Data

MDOH Bridge Number:	P 00007 095+0.085-1
Feature Crossed:	Clark Fork River
Number of Traffic Lanes:	Four
Roadway Lighting:	Yes
Sidewalk:	4-Feet-Wide Both Side
Deck:	Concrete
Width & Length:	68 Feet By 552 Feet
No. of Spans:	3 Main - Riveted Steel Plate Girders 1 Main - Steel Wide Flange Girder 2 Approach - Precast Concrete Beams
Substructures:	Concrete Piers & Bents With Spread Footings
Year Built:	1958
Rehabilitation:	Partial Deck Replacement in 1983
Design Loading:	HS-20
MDOH Sufficiency Rating:	76.3

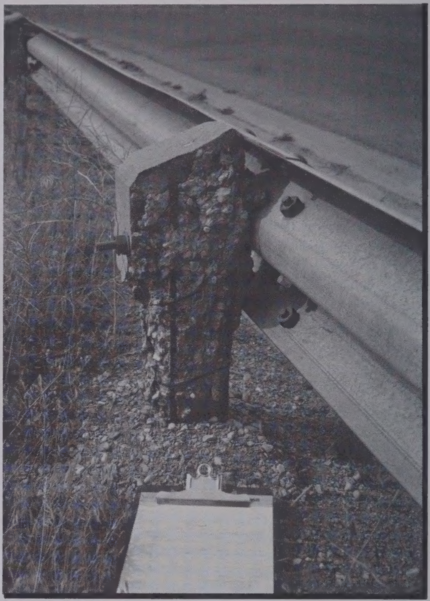
B. Summary of Structural Evaluation

The overall condition of this bridge is good. However, water leaking through the deck joints has caused heavy rusting of all but one of the steel support girders and bearings near each pier and bent. There is also cracking and spalling of concrete on the piers and bents with the rebar exposed in some areas. In addition, some approach guardrail posts are in very poor condition (see Photo Plate No. 1). The deck, which was partially replaced in 1983, has extensive transverse and map cracking, but is still in serviceable condition.

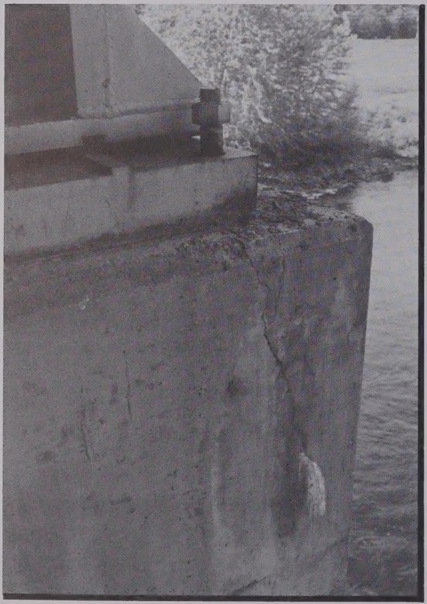
PHOTO PLATE NO. 1 - MADISON STREET RIVER BRIDGE



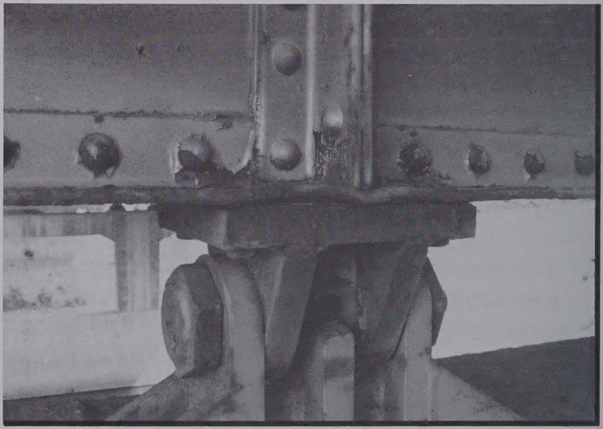
The Madison Street Bridge consists of riveted steel plate girders with concrete piers and bents on spread footings. This structure is 552 feet long and was built in 1958.



Some of the guardrail posts on the bridge approaches have spalled concrete and exposed rebar.



Corrosion in the bearing plate has loosened the anchor bolt and produced a crack in the concrete cap of this pier.



Rust has warped the bottom flange of this tranverse girder at the bearing support interface. Note that both nuts have popped off due to the pressure.

C. Summary of Operational Analysis

1. Bridge

The Madison Street bridge over the Clark Fork River is part of Federal Aid Primary route 7. A large portion of the traffic using this bridge are traveling between the I-90 interchange on Van Buren Street and the 5th/6th Street one-way couplet on the south side of the river.

The average daily traffic volume on the bridge was 19,800 vehicles in 1988. Traffic projections indicate that the bridge will carry 23,600 vehicles per day (VPD) in the year 2000 and 31,000 VPD by the year 2010.

The existing four lane configuration on the bridge will be able to handle the traffic volumes anticipated in the year 2010.

Four-foot-wide sidewalks have been provided on both sides of the bridge for pedestrians, while bicyclists typically share the 15-foot wide outside driving lane with motor vehicles.

2. Bridge Approaches

One operational concern is the alignment of the south bridge approach. The one-way couplet along 5th and 6th Streets currently terminates at Maurice Street. This configuration requires northbound traffic to circulate around the block between Arthur and Maurice Streets to get to the south bridge approach. It is desirable to redirect traffic onto the bridge along a more direct path.

A conceptual layout of the proposed realignment of the south approach to the bridge is presented in Figure No. 2. The realignment consists of extending the four traffic lanes from the bridge, south to the intersection of 6th and Arthur. This configuration would allow the northbound traffic to travel from 6th Street along Arthur Street directly to the bridge. The existing northbound approach could then be changed into a single lane approach ramp for northbound University traffic.

This alignment concept will require additional right-of-way in the area of the Jennette Rankin Park and along Arthur Street between 5th and 6th Streets.

Ken Stoltz, a planner for the University of Montana, was contacted concerning the possibility of an alignment change in the south approach. He indicated that the proposed realignment would benefit the University. According to Mr. Stoltz, the University plans to eventually acquire all of the property east of Arthur Street and north of Beckwith Avenue. The current flow of traffic from 5th Street to the bridge passes within that area. If the 6th Street traffic was redirected northbound along Arthur, it would alleviate many traffic problems that currently exist in the northwest portion of campus.

PHOTO PLATE NO. 1 - MADISON STREET RIVER BRIDGE

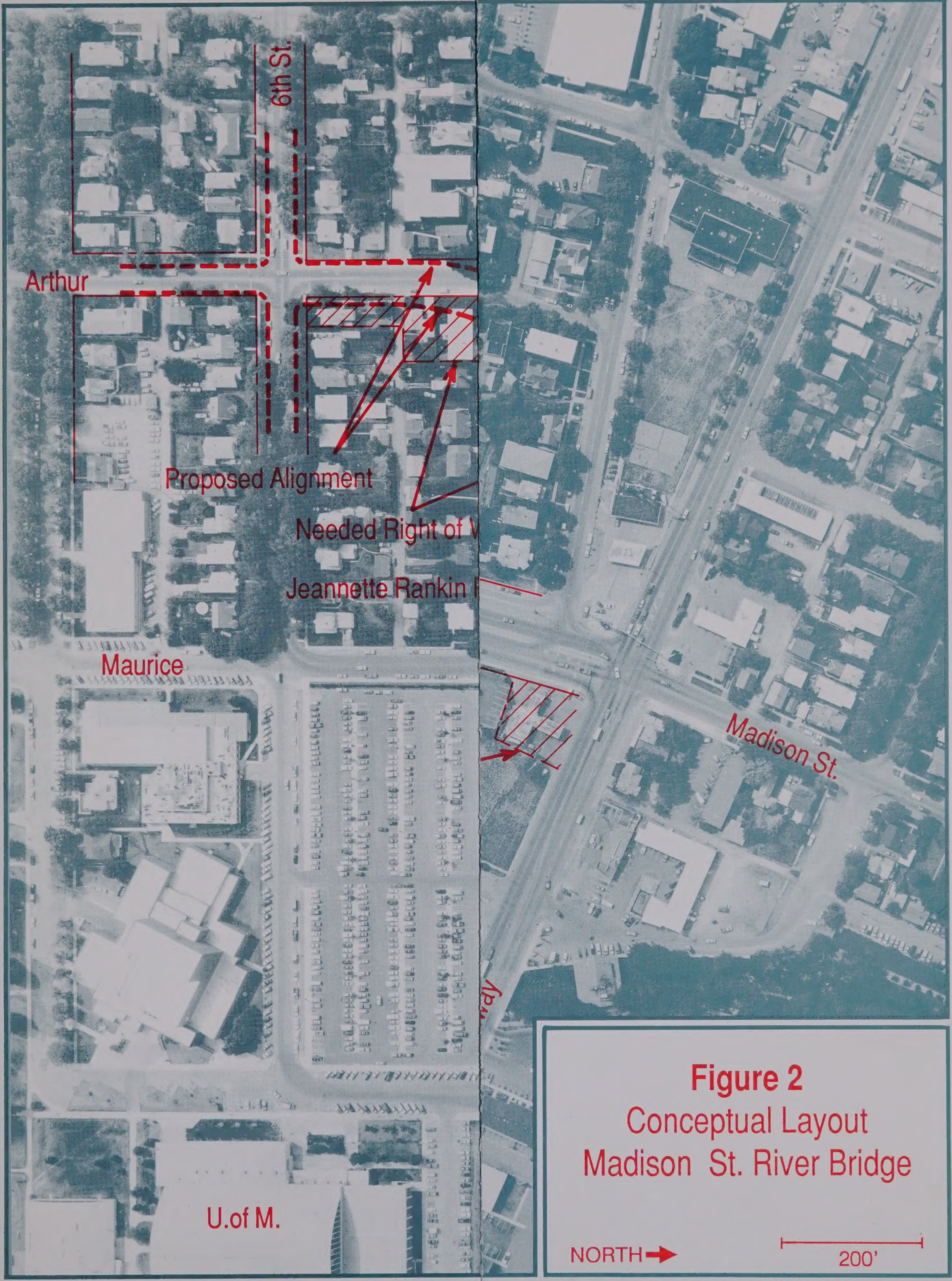


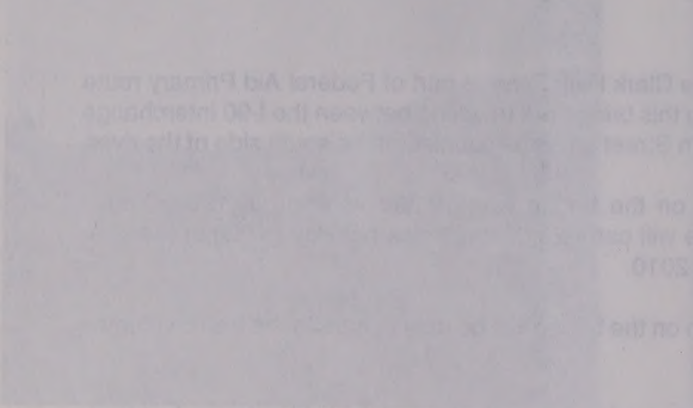
Figure 2

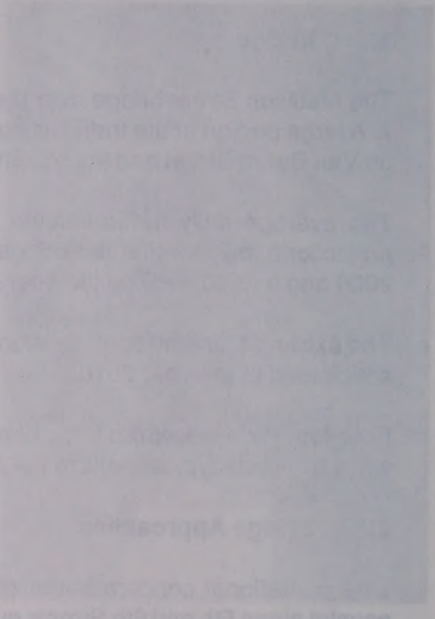
Conceptual Layout

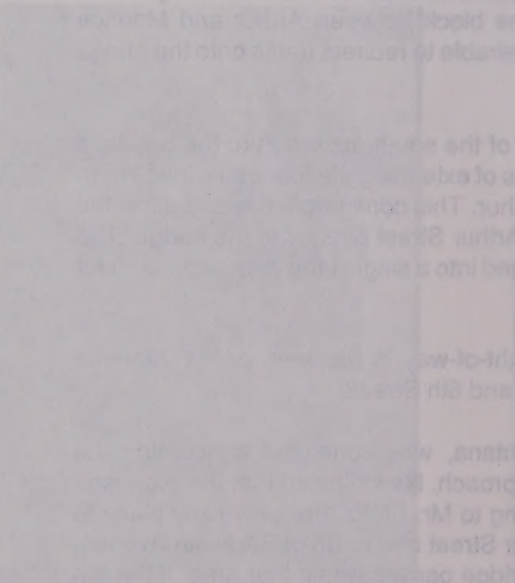
Madison St. River Bridge

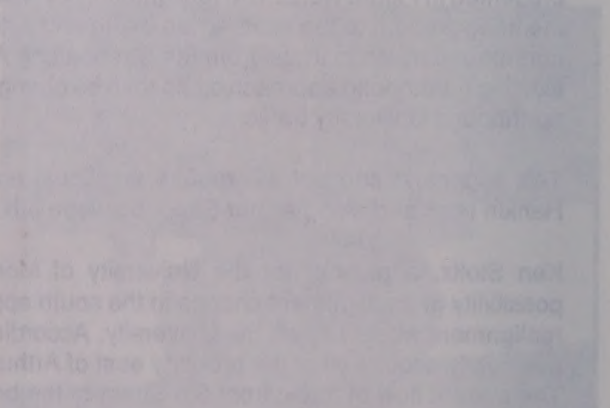
6th St.
Arthur
Proposed Alignment
Needed Right of W
Jeannette Rankin
Maurice
Madison St.
U.of M.
NORTH
200'

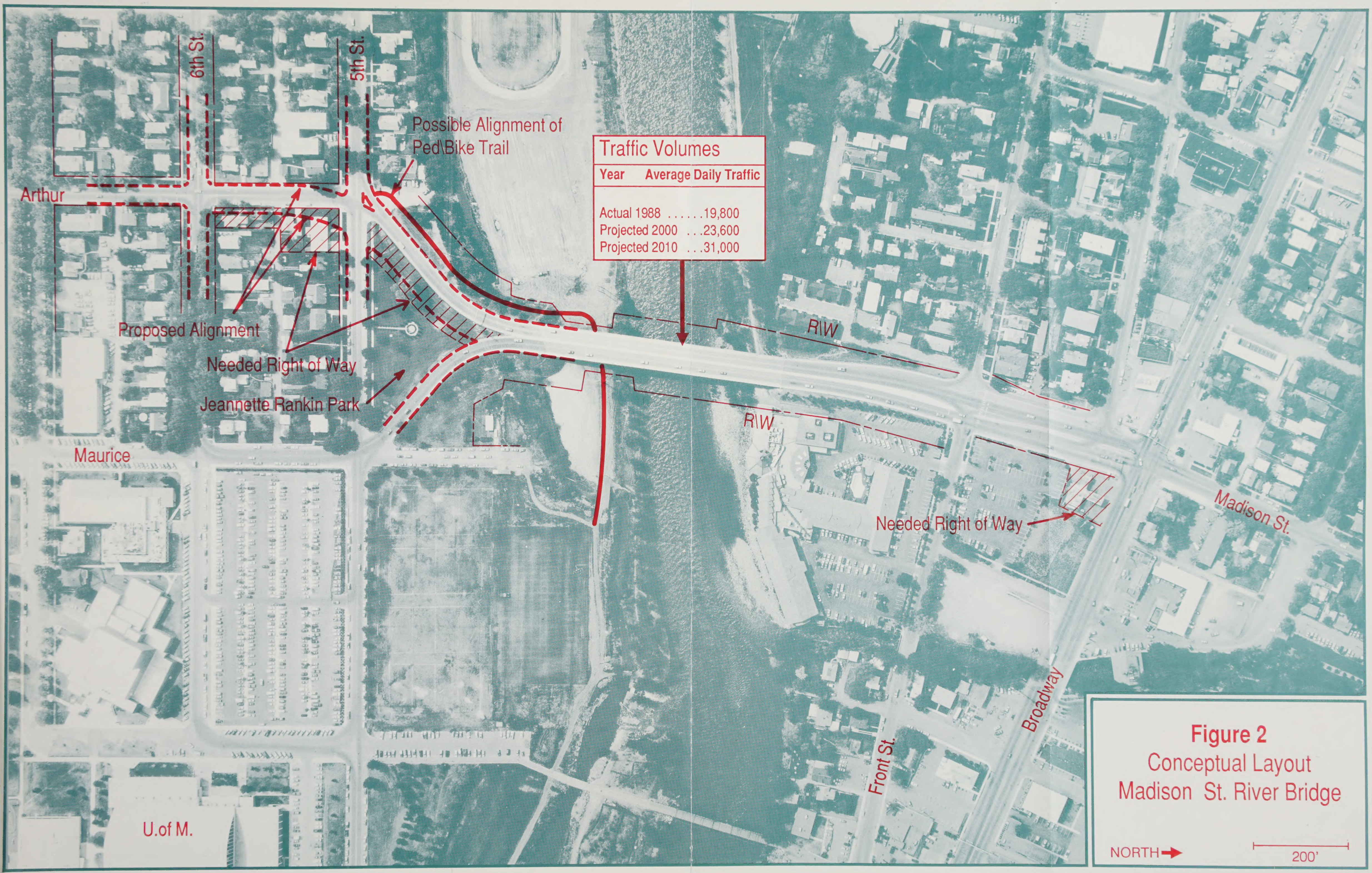
PHOTO PLATE NO. 1 - MADISON STREET RIVER BRIDGE










6th St.
5th St.
Possible Alignment of Ped\Bike Trail
Arthur
Proposed Alignment
Needed Right of Way
Jeannette Rankin Park
Maurice
U.of M.
R/W
R/W
Needed Right of Way
Madison St.
Broadway
Front St.
NORTH
200'

Traffic Volumes

Year	Average Daily Traffic
Actual 1988	19,800
Projected 2000	23,600
Projected 2010	31,000

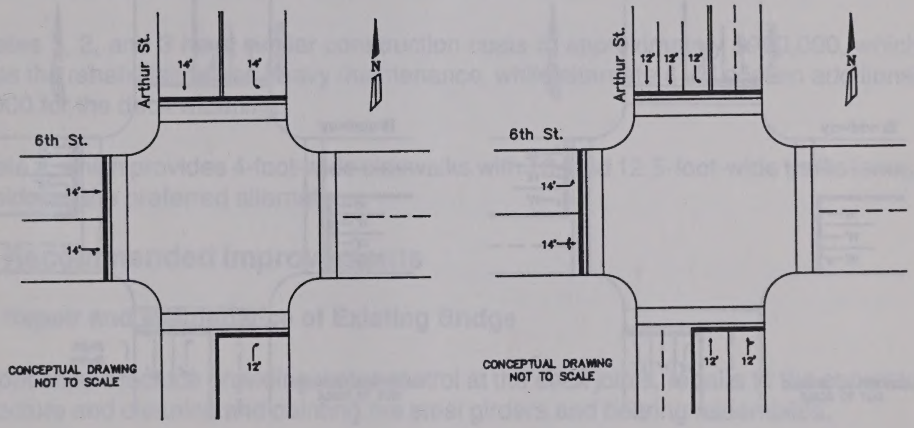
Figure 2
Conceptual Layout
Madison St. River Bridge

The conceptual layout in Figure No. 2 also shows a possible alignment of a pedestrian/bicycle trail that would allow southbound University bicycle traffic to be rerouted along the west side of the bridge approach and under the bridge. This trail will enable the University-bound bicyclist to avoid the problems associated with turning left on Arthur Street into the campus. The AASHTO Guide for Development of New Bicycle Facilities indicates that a two way bicycle trail that will be shared with pedestrians should be a minimum of 12 feet wide.

3. Adjacent Intersections

The Arthur Street corridor is currently carrying approximately 8,000 vehicles per day (VPD). This traffic volume is projected to increase to over 12,000 VPD by the year 2010. It will be necessary to widen Arthur Street to four lanes to accomodate this traffic. If the south approach is realigned as described above, the signalized intersection of 6th and Arthur Streets will have to be modified so it can accommodate the new turning movements. The necessary intersection configuration is shown in Figure No. 3.

Figure No. 3 - Intersection of 6th and Arthur



EXISTING CONFIGURATION

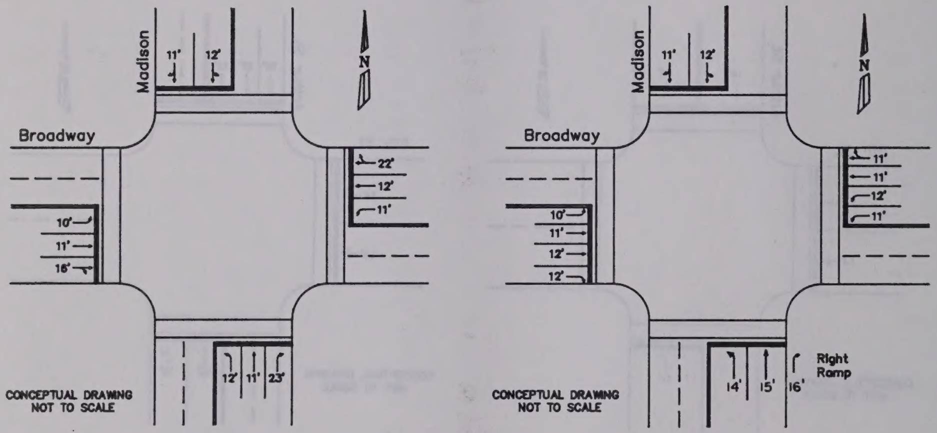
CONFIGURATION NEEDED FOR YEAR 2010 TRAFFIC

The intersection of 5th and Arthur Streets will also need to be modified if the bridge approach is realigned. The south approach to the intersection will require two through traffic lanes and a left turn lane. It is assumed that the one-way traffic flow pattern on 5th between Arthur and Maurice will be continued. This intersection will require signalization to handle the anticipated traffic volumes.

The greatest traffic problem on the Madison Street corridor is the intersection of Madison and Broadway. This signalized intersection is currently operating at level-of-service F. In order for this intersection to operate at an acceptable level-of-service it will have to be modified to include a double left turn movement from the east approach and a right turn ramp on the south approach. Additional right-of-way will be required on the southwest corner for the right turn ramp. This lane use configuration will provide level of service C through the year 2000.

By the year 2010 the traffic volumes will require Madison Street, north of the Broadway intersection, to be widened to four lanes and an additional approach lane be added to the west approach on Broadway. Figure No. 4 shows the existing intersection configuration and the intersection modifications that will be needed to handle the traffic load in the year 2010.

Figure No. 4 - Intersection of Madison and Broadway


Madison
11'
12'
N
Broadway
22'
12'
11'
10'
11'
16'
12'
11'
23'
CONCEPTUAL DRAWING
NOT TO SCALE
Madison
11'
12'
N
Broadway
11'
11'
12'
11'
10'
11'
12'
12'
14'
15'
16'
Right
Ramp
CONCEPTUAL DRAWING
NOT TO SCALE

EXISTING CONFIGURATION

CONFIGURATION NEEDED FOR
YEAR 2010 TRAFFIC

D. Alternatives Considered

Typically, whenever a bridge undergoes a major rehabilitation project it is also upgraded to meet current standards. AASHTO's Standard Specifications for Highway Bridges states that when sidewalks are used for pedestrian traffic on urban bridges the walkways are to be separated from the driving lanes by a continuous traffic barrier. A typical traffic barrier design consists of a Jersey type concrete barrier with a tubular railing attached along the top.

When the Madison Street Bridge is rehabilitated traffic barriers will have to be added. Each barrier is approximately one and a half feet wide at the base. The space allocated for sidewalks and driving lanes will have to be modified in order to accommodate the new barriers.

The new traffic barriers will tend to make the existing 4-foot sidewalks seem too narrow. The barrier will have a similar effect on the outside traffic lane. The barriers will reduce the effective width of the lane because motorists usually require a minimum of two feet of shy distance from any continuous fixed object adjacent to the road.

The alternatives considered for the revised bridge deck are shown in Figure No. 5.

Alternate 1 shows how the barrier would fit on the deck if no other modifications were made. Alternates 2 and 3 show how the width of the bridge could be used if the center median was removed. The fourth alternative involves widening the existing deck to accommodate a pedestrian/bicycle lane on each side of the bridge.

Alternates 1, 2, and 3 have similar construction costs of approximately $900,000, which includes the rehabilitation and heavy maintenance, while alternate 4 will cost an additional $400,000 for the deck widening.

Alternate 2, which provides 4-foot-wide sidewalks with 16- and 12.5-foot-wide traffic lanes, is considered the preferred alternate.

E. Recommended Improvements

1. Repair and Maintenance of Existing Bridge

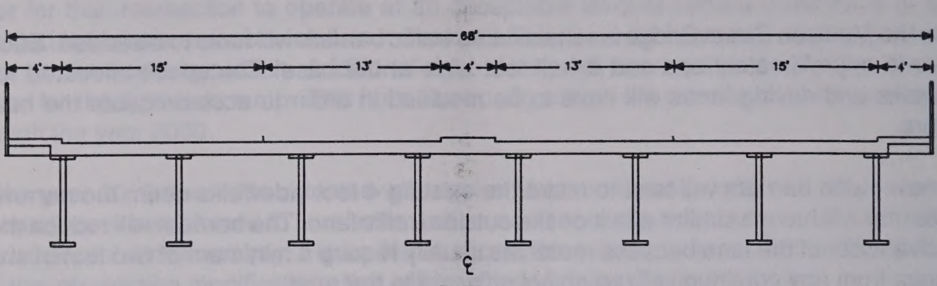
This work should include providing water control at the deck joints, repairs to the concrete substructure and cleaning and painting the steel girders and bearing assemblies.

Estimated Cost: $ 275,000

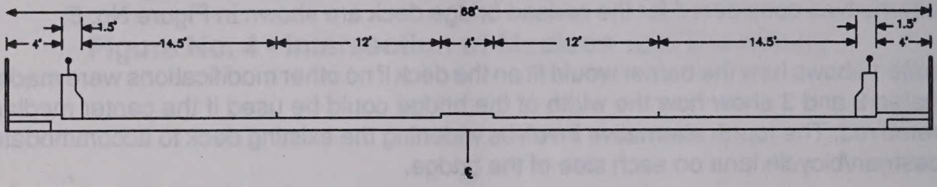
2. Major Rehabilitation of Existing Bridge (Alternate No. 3)

This bridge was built in 1958 and received a partial deck replacement in 1983. The bridge needs rehabilitation and heavy maintenance. It is recommended that this be done by a regular construction contract. The problems caused by water leaking through deck joints are of greatest concern. This water is causing corrosion of steel beams, girders and bearing assemblies and concrete deterioration. As some water will always leak through the deck joints, it must be controlled from underneath to prevent additional damage and very costly future repairs.

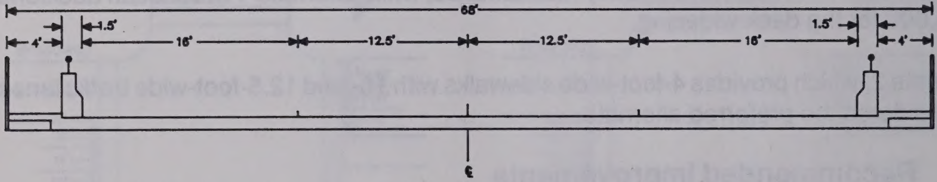
Figure No. 5 - Alternatives Considered - Madison St. River Bridge


℄
68'
4'
15'
13'
4'
13'
15'
4'
℄

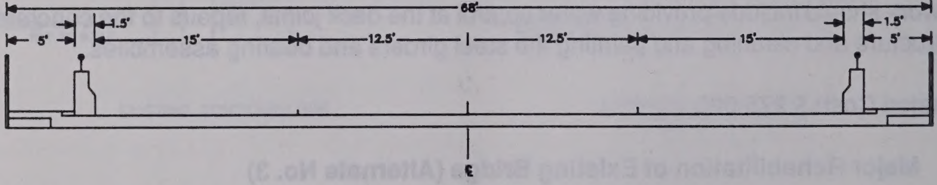
EXISTING


68'
1.5'
4'
14.5'
12'
4'
12'
14.5'
1.5'
4'
℄

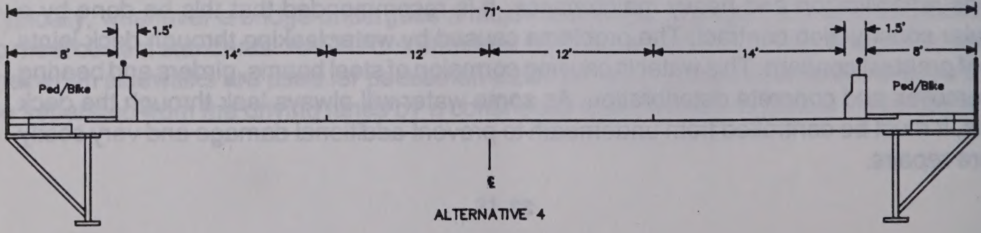
ALTERNATIVE 1


68'
1.5'
4'
16'
12.5'
12.5'
16'
1.5'
4'
℄

ALTERNATIVE 2 (Preferred)


68'
1.5'
5'
15'
12.5'
12.5'
15'
1.5'
5'
℄

ALTERNATIVE 3


71'
1.5'
8'
14'
12'
12'
14'
1.5'
8'
Ped/Bike
Ped/Bike
℄

ALTERNATIVE 4

The rehabilitation work should consist of installing traffic barriers, removing the center median, repairing and painting the existing handrail, repairing and widening the sidewalk, resealing the concrete bridge deck, repairing the expansion joints, providing earthquake retrofit assemblies to the beam end connections, and replacing damaged approach guardrail posts.

This work will greatly prolong the useful life of the bridge. After the proposed work is completed, the structure should have a useful life of more than 40 years. However, in about 20 years, the bridge will likely need another partial or a total deck replacement.

If the repair and maintenance project discussed in item 1 is not implemented, the cost of those work items ($275,000) should be added to the rehabilitation project. The cost of the repair and maintenance items will increase with time due to continued deterioration.

Estimated Cost: $890,000

3. Realign the South Bridge Approach

Reconstruct the south bridge approach by extending the four traffic lanes south from the bridge along Arthur Street to 6th Street. This project should include acquiring the needed right-of-way, realigning the south bridge approach, widening Arthur Street between 5th and 6th Streets, and modifying the intersection of 6th and Arthur.

Estimated Cost: $590,000

4. Modify Intersection of Madison and Broadway

This intersection should be altered to include two left turn lanes on the east approach and a right turn ramp on the south approach. The right turn ramp will require additional right-of-way.

Estimated Cost: $245,000

5. Construct a Pedestrian/Bicycle Trail Along the South Approach

A 12-foot-wide paved trail for pedestrian/bicycle use should be constructed along the west side of the south bridge approach. The trail should begin at the 5th and Arthur intersection and follow the edge of the right-of-way down towards the river and under the bridge. The trail should extend to the east and connect to the University trail system.

Estimated Cost: $25,000

Site 2

Higgins Avenue River Bridge

SITE 2 - HIGGINS AVENUE RIVER BRIDGE

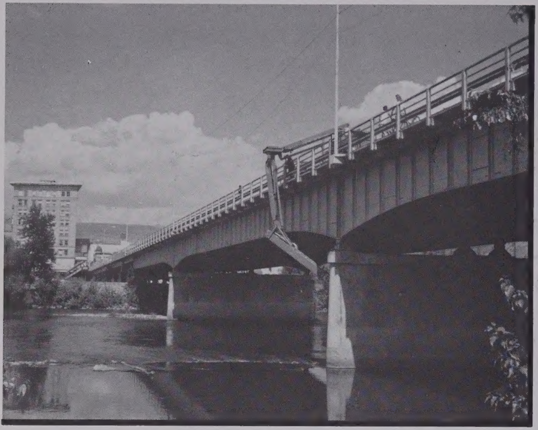
A. General Data

MDOH Bridge Number:	U 08113 00+0.238-1
Features Crossed:	Clark Fork River
Number of Traffic Lanes:	Four
Roadway Lighting:	Yes
Sidewalks:	5-feet-wide both sides
Deck:	Concrete
Width and Length:	66 feet by 972 feet
Number of Spans:	4 Main - Riveted steel girders 7 Approach - Prestressed concrete girders 3 Approach - Steel wide flange beams
Substructure:	Concrete piers and bents on spread footings
Year Built:	1962
Rehabilitation:	Partial deck replacement in 1983
Design Loading:	H20-S16
MDOH Sufficiency Rating:	75.3

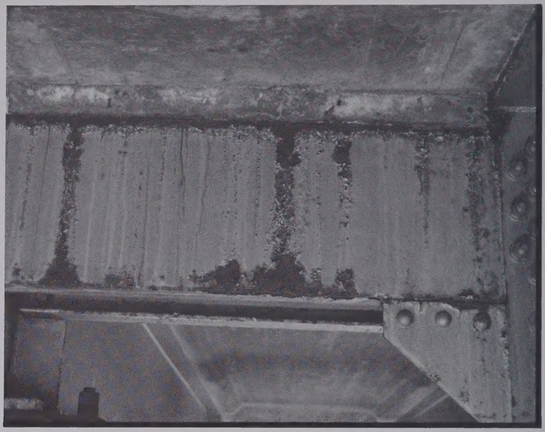
B. Summary of Structural Evaluation

The overall condition of this bridge is fair. The biggest problems are associated with deck joint leakage and the resulting steel corrosion and concrete spalling at the support bents and piers. The steel girders have moderate to heavy corrosion near these joints, but are in good condition otherwise. The concrete deck surface has extensive traverse and map cracking, but has no spalling or other problems. Some piers and bents have areas where the concrete is cracking and spalling (see Photo Plate No. 2).

PHOTO PLATE NO. 2 - HIGGINS AVENUE RIVER BRIDGE

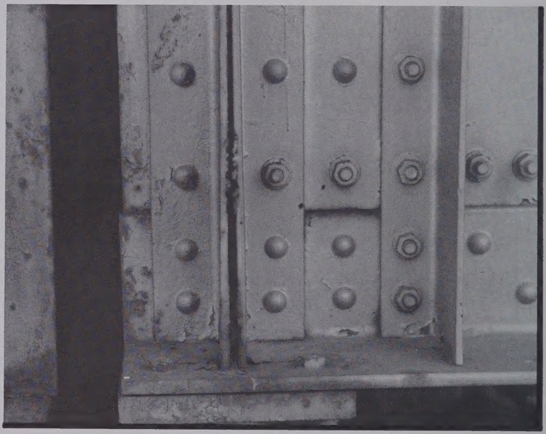


The main spans of the Higgins Street Bridge are riveted steel girders on concrete piers and bents. The Department of Highways "snooper" truck, shown in this photo, was used to assist the structural engineer perform the bridge inspections.



The corrosion of this steel end diaphram is caused by water leaking through the deck joint from above.

Spalling of the concrete on this support column of a bent has left the rebar exposed. This type of concrete deterioration was evident in several places on the support columns.



Water from a leaking deck joint has caused the steel to corrode in this double vertical bearing brace. The corrosion has produced forces which have broken the welds and separated the braces.

C. Summary of Operational Analysis

1. Bridge

This 4-lane bridge carried an average of 17,900 vehicles per day (VPD) in 1988. The average daily traffic volume is projected to increase to only 20,300 VPD by the year 2010. The Higgins Avenue bridge should have no problem handling the projected traffic.

The bridge has 5-foot-wide sidewalks on both sides for pedestrian use. There are two sets of stairs on the north end of the bridge and one set on the south end that allow pedestrians to access the riverside development and parking areas below the bridge.

Bicyclists travel across the bridge sharing the 14-foot-wide outside driving lane with the motor vehicles.

A plan view of the bridge is shown in Figure No. 6.

2. Bridge Approaches and Adjacent Intersections

The bridge approaches function effectively and are in good condition. The one-way traffic pattern created by Front and Main Streets causes some circulation problems north of the bridge. This circulation pattern tends to affect the out-of-town traveler more than the local commuter who is familiar with the downtown area.

The intersection of Higgins and 3rd Street is located immediately south of the bridge. The location of the intersection causes only a minor amount of side friction. Access to and from 3rd Street is provide by short ramp connectors that tend to minimize the interference with the through traffic.

Several signalized intersections on Higgins Avenue will have trouble handling the anticipated traffic volumes. These locations include the intersections at Broadway, 5th Street, 6th Street, and Brooks. In most of these cases the solution to the capacity problems will take the form of restricting parking and limiting turning movements and will not affect the bridge or the approaches.

D. Alternatives Considered

When this bridge is rehabilitated it will be necessary to bring the bridge up to current design standards. This means that the existing inside pedestrian railings will have to be removed and replaced by concrete traffic barriers. These barriers will occupy three feet of the deck that is currently being used for vehicle travel. Several deck layout alternatives were developed and are shown in Figure No. 7.

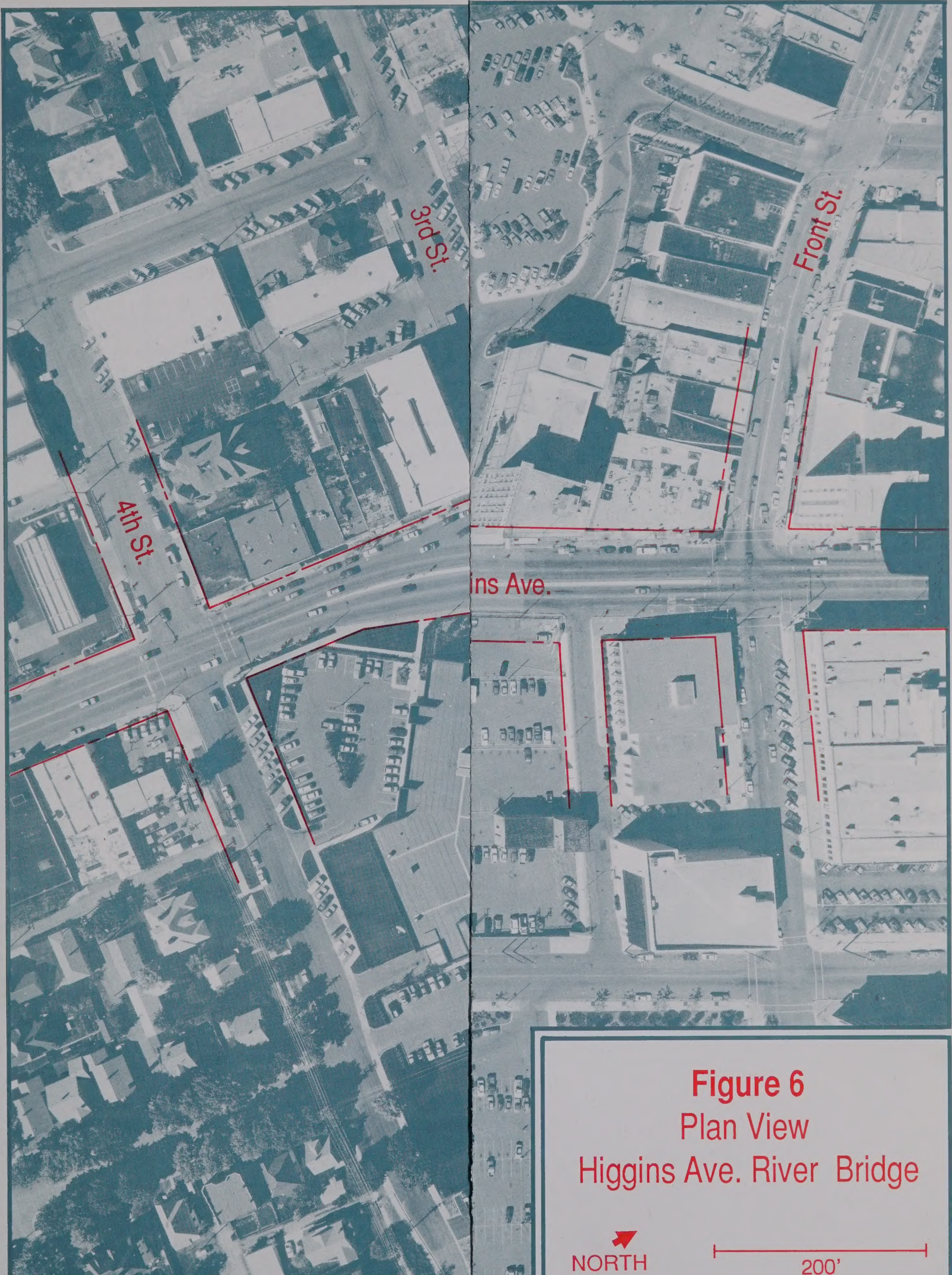
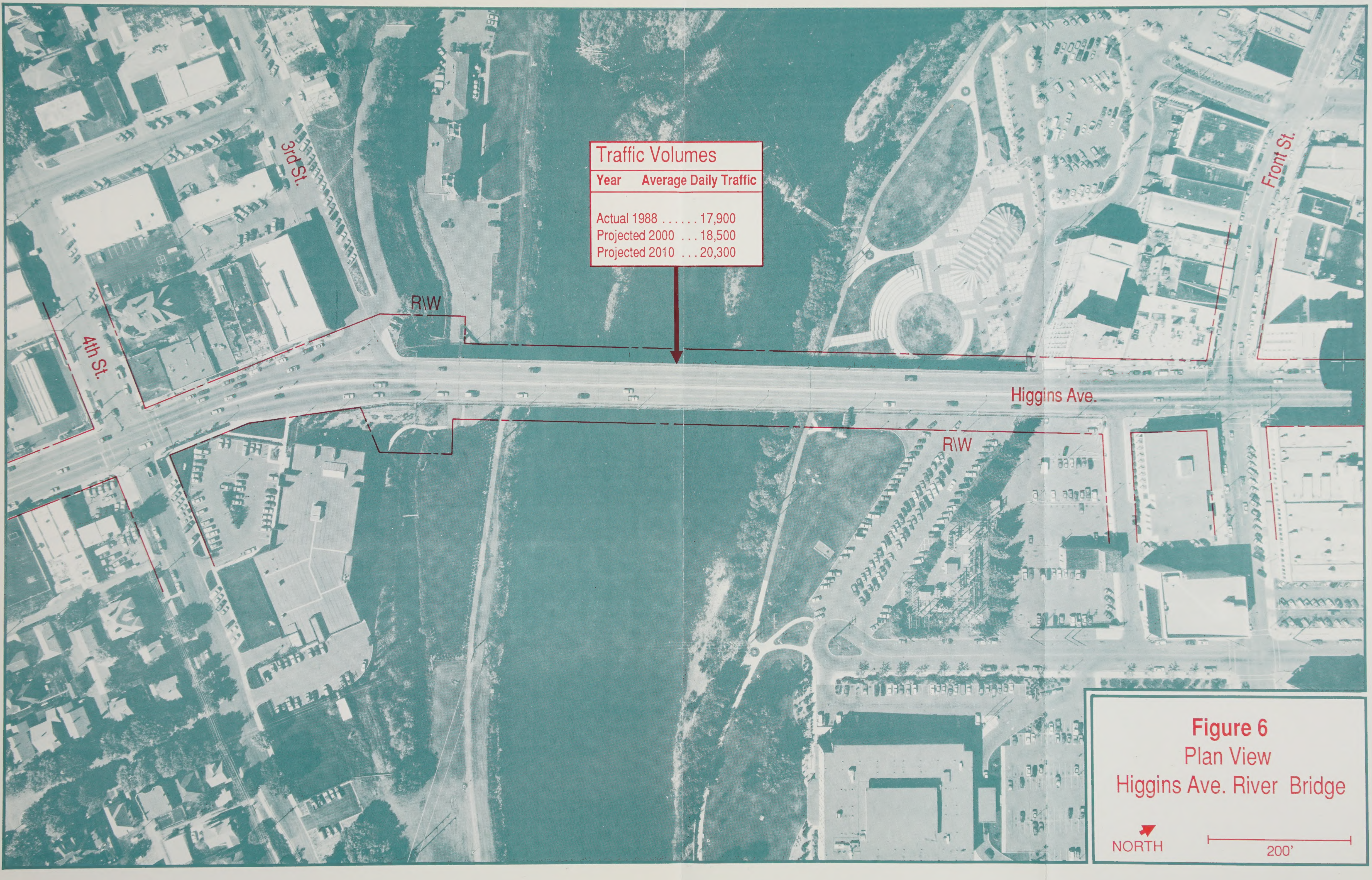

3rd St.
Front St.
4th St.
ins Ave.
NORTH
200'

Figure 6
Plan View
Higgins Ave. River Bridge

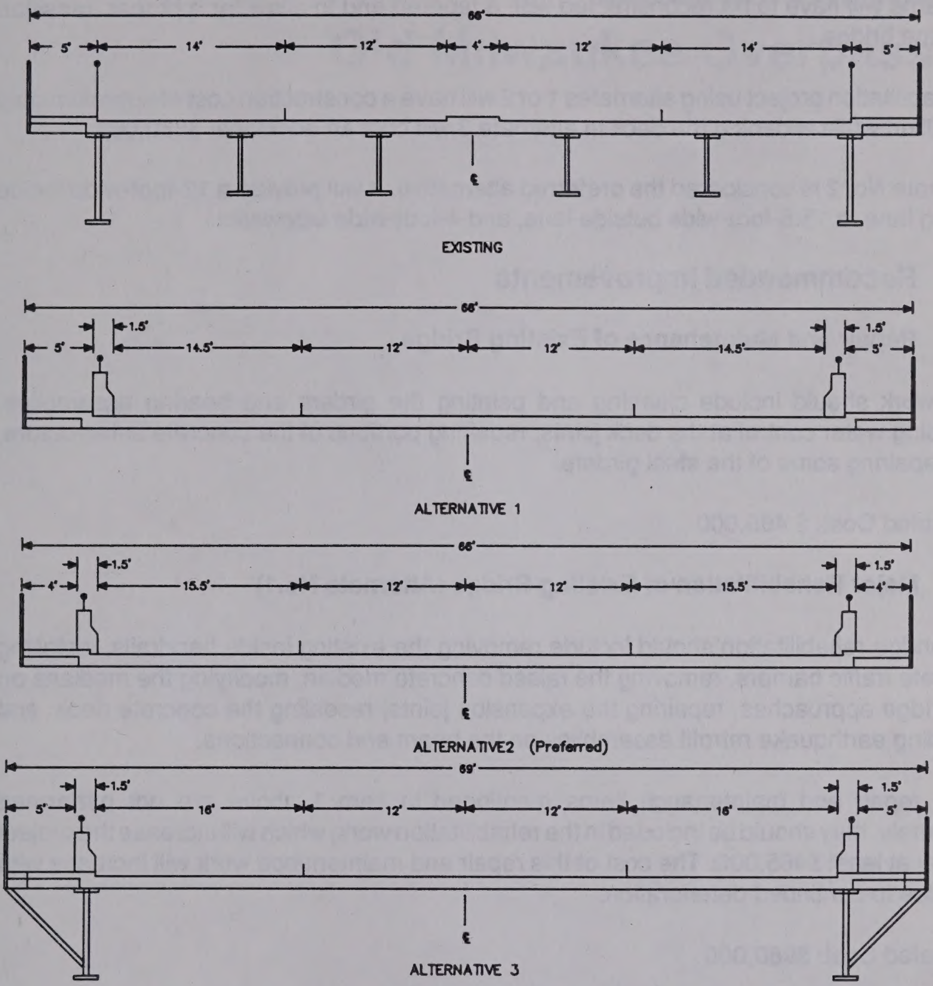

3rd St.
4th St.
R/W
R/W
Higgins Ave.
Front St.
NORTH
200'

Traffic Volumes

Year	Average Daily Traffic
Actual 1988	17,900
Projected 2000	18,500
Projected 2010	20,300

Figure 6
Plan View
Higgins Ave. River Bridge

Figure No. 7 - Alternatives Considered - Higgins Ave. River Bridge


66'
5'
14'
12'
4'
12'
14'
5'
℄
EXISTING
66'
1.5'
5'
14.5'
12'
12'
14.5'
1.5'
5'
℄
ALTERNATIVE 1
66'
1.5'
4'
15.5'
12'
12'
15.5'
1.5'
4'
℄
ALTERNATIVE2 (Preferred)
69'
1.5'
5'
16'
12'
12'
16'
1.5'
5'
℄
ALTERNATIVE 3

Alternate No. 1 and 2 are similar with the exception of the sidewalk width. Alternate No. 1 provides 5-foot-wide sidewalks, which are desirable for the comfort of the pedestrians, and 14.5-foot-wide outside driving lanes. Alternate No. 2 has wider outside travel lanes (15.5') which are desirable for the safety of the bicyclists and 4-foot-wide sidewalks. Alternate No. 3 involves widening the bridge deck to provide additional space for 5-foot-wide sidewalks and 16-foot-wide outside driving lanes.

All three alternates include the removal of the concrete raised median. This is necessary in order to provide adequate travel lane widths. The raised medians on the bridge approaches are currently used to restrict undesirable turning movements. These approach mediams will have to be reconstructed with a tapered end to allow for a proper transition near the bridge.

A rehabilitation project using alternates 1 or 2 will have a construction cost of approximately $1 million while widening the deck in alternate 3 will cost an additional $680,000.

Alternate No. 2 is considered the preferred alternative. It will provide a 12-foot-wide inside driving lane, a 15.5-foot-wide outside lane, and 4-foot-wide sidewalks.

E. Recommended Improvements

1. Repair and Maintenance of Existing Bridge

This work should include cleaning and painting the girders and bearing assemblies, providing water control at the deck joints, repairing portions of the concrete substructure, and repairing some of the steel girders.

Estimated Cost: $ 465,000

2. Major Rehabilitation of Existing Bridge (Alternate No.1)

The bridge rehabilitation should include removing the existing inside handrails, installing concrete traffic barriers, removing the raised concrete median, modifying the medians on the bridge approaches, repairing the expansion joints, resealing the concrete deck, and providing earthquake retrofit assemblies on the beam end connections.

If the repair and maintenance items mentioned in item 1 above are not performed separately, they should be included in the rehabilitation work, which will increase the project cost by at least $465,000. The cost of this repair and maintenance work will increase with time due to continued deterioration.

Estimated Cost: $980,000

Site 3

Orange Street
Old Milwaukee Overpass

SITE 3 - ORANGE STREET OLD MILWAUKEE OVERPASS

A. General Data

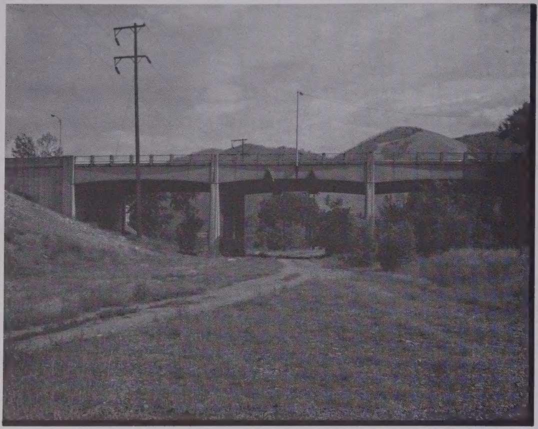
MDOH Bridge Number:	U 08107 00+0.410-1
Features Crossed:	Irrigation canal and abandoned railroad
Number of Traffic Lanes:	Two
Roadway Lighting:	Yes
Sidewalks:	5-feet-wide both sides
Deck:	Concrete with asphalt overlay
Width and Length:	43 feet by 209 feet
Number of Spans:	3 Main - Concrete girder
Substructure:	Concrete bents
Year Built:	1936
Rehabilitation:	None
Design Loading:	H15
MDOH Sufficiency Rating:	None

B. Summary of Structural Evaluation

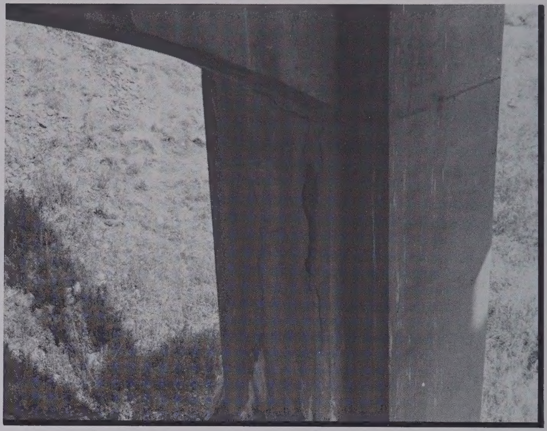
This bridge is in fair condition. The concrete deck, which has been overlayed with asphalt, shows signs of some deteriation. There is vertical and diagonal cracking in all of the support beams, but they still appear to be satisfactory and serviceable. The support bents have areas of large spalls and cracking, but are also functional.

There are no approach guardrails, and the bridge railings are inadequate by current standards. The sidewalks and curbs have some spalling and vehicle damage, but are serviceable (see Photo Plate No. 3).

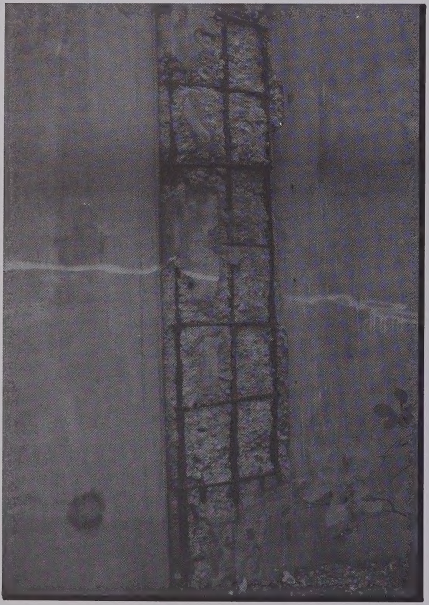
PHOTO PLATE NO. 3 - ORANGE STREET OLD MILWAUKEE OVERPASS



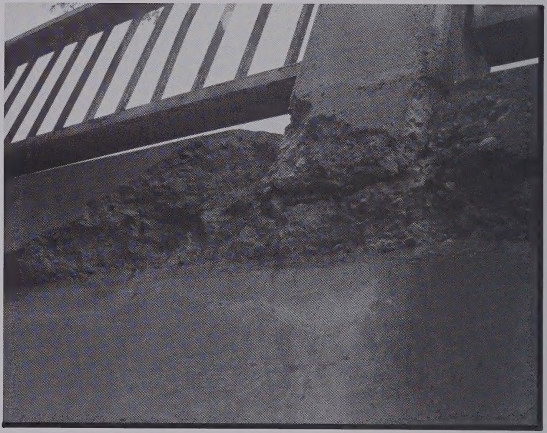
The Old Milwaukee overpass was built in 1936 and consists of concrete girders on concrete bents. The old railroad bed has been completely removed.



Concrete cracking and spalling have caused some exterior delamination of this bent.



The structural steel in this abutment column is exposed from concrete deterioration.



This concrete bridge railing connection has been weakened by cracking and spalling concrete.

C. Summary of Operational Analysis

1. Bridge

The average daily traffic on this bridge in 1988 was 15,700 vehicles. This volume is projected to increase to 19,600 by the year 2000 and to 21,900 vehicles by the year 2010.

A plan view of this overpass showing the adjacent river bridge is shown in Figure No. 8.

This 2-lane bridge is adequately handling the current traffic volume, but it will become a problem as traffic increases. The Orange Street corridor south of the bridge is planned to be widened to 4-lanes in the future. When this occurs the two lane bridge will be a major bottleneck.

From an operational standpoint, this bridge is no longer needed due to the closing of the Milwaukee Railroad Line. The canal can cross under Orange Street using a conventional culvert, while the pedestrian and bicycle traffic traveling along the Old Milwaukee railroad alignment can be reroute under the river bridge. The concept of providing an underpass structure at this location for pedestrian and bicycle traffic was examined and considered undesirable from a safety standpoint.

D. Recommended Improvements

1. Remove Overpass

Although this bridge is in fair condition, it is no longer needed. It should be maintained only on a cost effective basis. This bridge should be scheduled for removal consistent with the cost of maintenance and the overall roadway plan for the Orange Street corridor. A concrete box culvert or a multiplate steel arch pipe should be used for the canal when the bridge is removed. The bridge opening should be filled in to the new road grade incorporating the demolished bridge material in the fill. The new road grade should be lowered as design permits.

Estimated Cost: $ 370,000

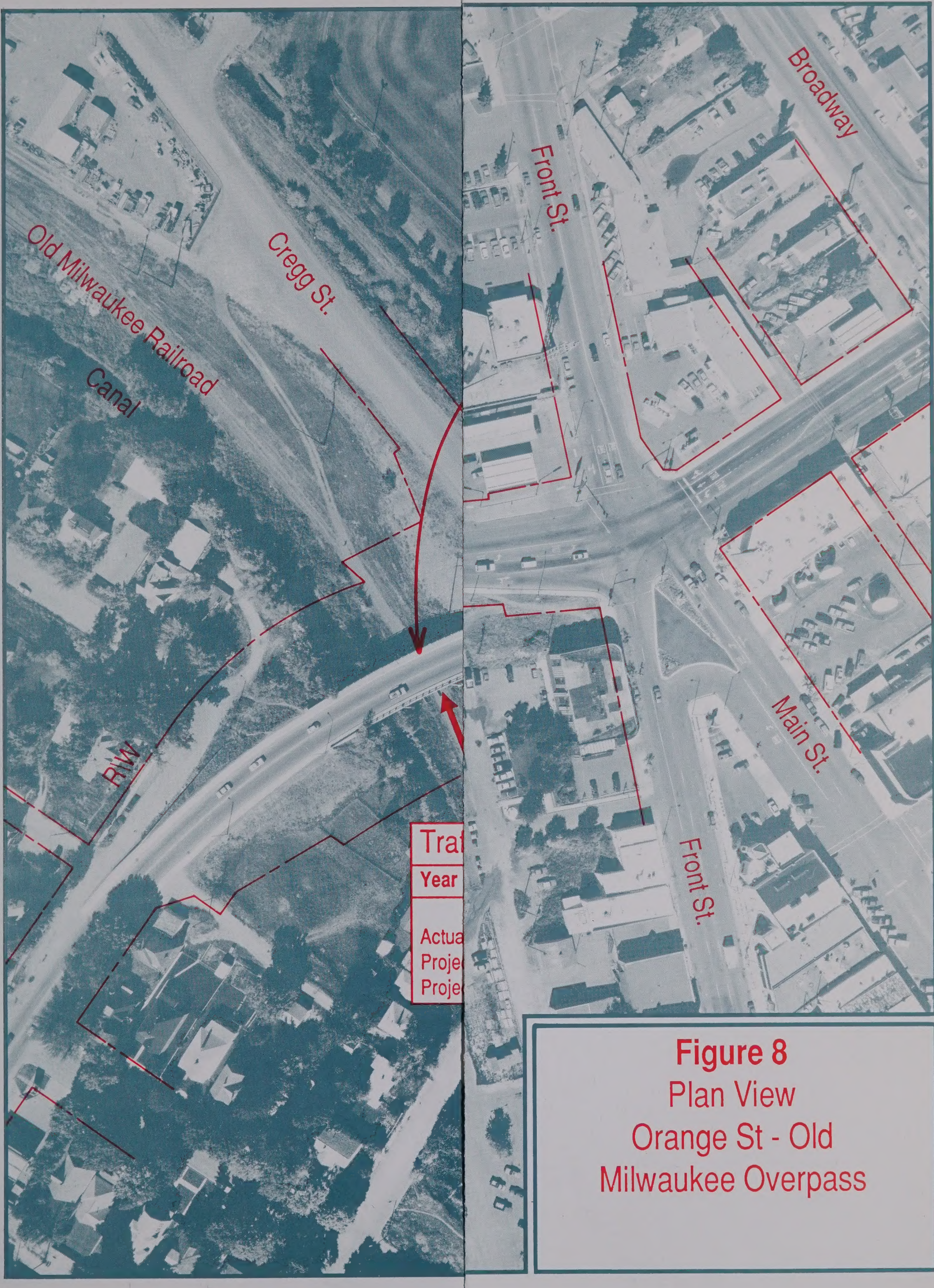
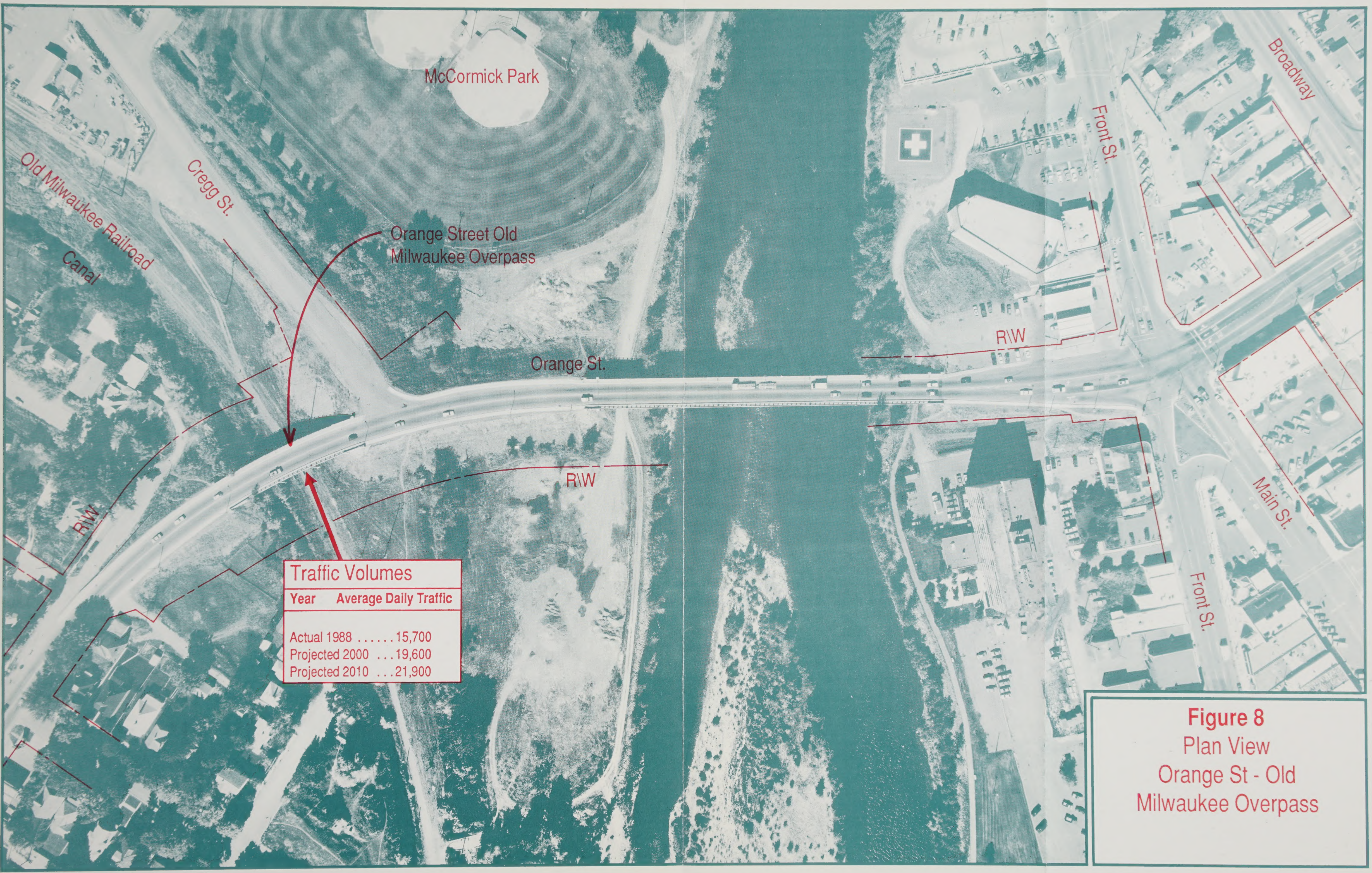

Broadway
Front St.
Cregg St.
Old Milwaukee Railroad
Canal
R/W
Main St.
Front St.
Traf
Year
Actua
Projec
Projec

Figure 8
Plan View
Orange St - Old
Milwaukee Overpass


McCormick Park
Broadway
Front St.
Cregg St.
Old Milwaukee Railroad
Canal
Orange Street Old Milwaukee Overpass
Orange St.
R\W
R\W
R\W
Main St.
Front St.

Traffic Volumes

Year	Average Daily Traffic
Actual 1988	15,700
Projected 2000	19,600
Projected 2010	21,900

Figure 8
Plan View
Orange St - Old
Milwaukee Overpass

Site 4
Orange Street River Bridge

SITE 4 - ORANGE STREET RIVER BRIDGE

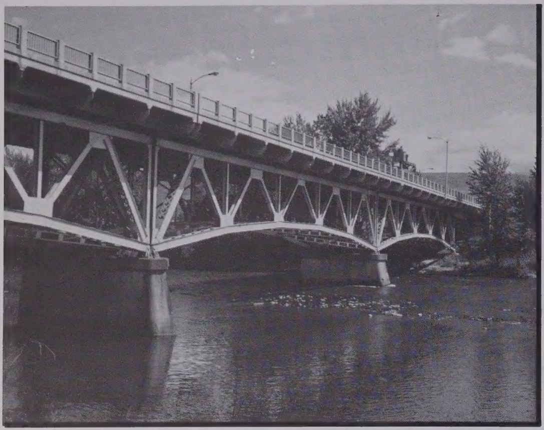
A. General Data

MDOH Bridge Number:	U 08107 001+0.540-1
Features Crossed:	Clark Fork River
Number of Traffic Lanes:	Two
Roadway Lighting:	Yes
Sidewalks:	5-feet-wide both sides
Deck:	Concrete with asphalt overlay
Width and Length:	43 feet by 503 feet
Number of Spans:	3 Main - Steel deck truss
Substructure:	Concrete piers and bents
Year Built:	1937
Rehabilitation:	None
Design Loading:	H15
MDOH Sufficiency Rating:	49.0

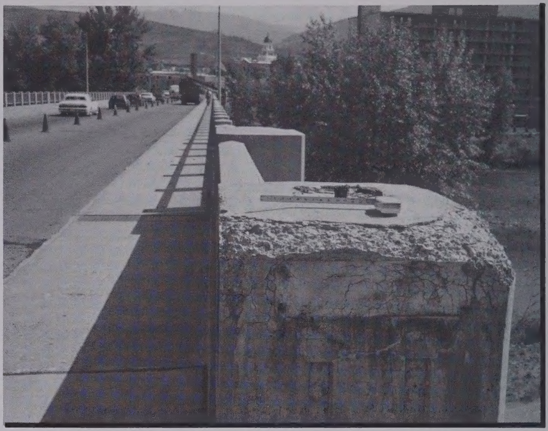
B. Summary of Structural Evaluation

The overall condition of the bridge is fair, but it does have deficiencies that should be corrected with heavy maintenance and some rehabilitation. The deck is covered with an asphalt overlay so the top of the original concrete deck cannot be observed. Efflorescence under the deck indicates that there is some concrete deterioration. The joints are uneven with the deck and all of them leak, causing heavy rusting of steel members and bearings and concrete spalling. The concrete reinforcing on the underside of the sidewalks is exposed causing accelerated deterioration. The guardrails on the bridge have some damage and have massive concrete end sections that are fully exposed to traffic. Although the approach from the south is on a high fill, there are no approach guardrails (see Photo Plate No. 4).

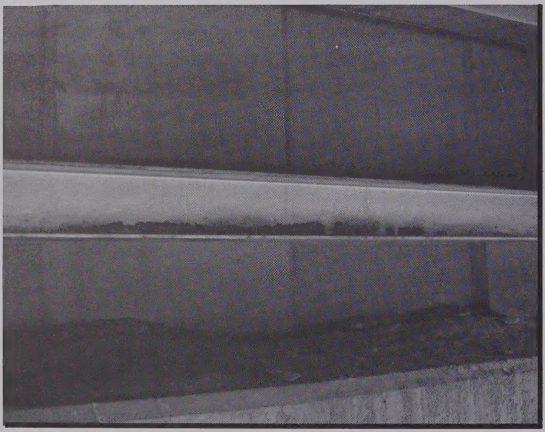
PHOTO PLATE NO. 4 - ORANGE STREET RIVER BRIDGE



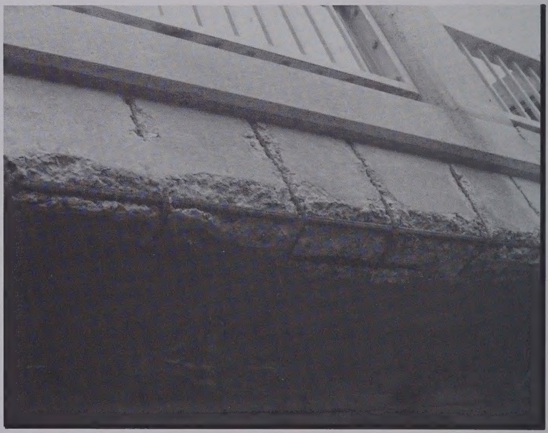
The Orange Street Bridge, built in 1937, is a steel truss on concrete piers and bents. The steel truss needs to be cleaned and repainted to prevent additional corrosion and rust.



This section of bridge railing shows extensive concrete deterioration.



The web of this laterial steel end brace has rusted completely through due to water leaking from the deck joint above.



The bridge deck has deteriorated due to cracking and spalling of the concrete. Note the exposed rebar.

C. Summary of Operational Analysis

1. Bridge

The Orange Street bridge is a 2-lane structure with 15-foot-wide driving lanes and 5-foot-wide sidewalks. This bridge carried approximately 15,700 vehicles per day (VPD) in 1988. By the year 2010 this volume is projected to increase to 21,900 VPD. The existing bridge is operating poorly under the current traffic volume loadings.

2. Bridge Approaches and Adjacent Intersections

The Orange Street corridor and the adjacent intersections will tend to control the size of the bridge. Orange Street from Front Street north to Alder Street was recently reconstructed to a 60-foot-wide, 4-lane road with a center double left turn lane.

Orange Street from Stephens Avenue north to the 1st Street intersection is planned to be similarly widened in the early 1990's. It will become very desirable to have a 4-lane bridge over the river at that time.

The logical and most cost effective method of widening the bridge is to construct another structure immediately adjacent to the existing one. The existing right-of-way and the alignment of the roadway suggest that the new structure should go on the upstream side of the existing bridge. Figure No. 9 shows the right-of-way limits and a conceptual layout of the new bridge and the approaches. Additional right-of-way will be required on both sides of the river to accomodate the new structure.

It is assumed that the Old Milwaukee Overpass will be removed at the time the river bridge is expanded to four lanes. After the overpass is removed, the height of the roadway can be lowered to produce a flatter approach grade to the river bridge. Lowering the level of the roadway will also improve the grade on Cregg Lane which leads down to McCormick Park. Figure No. 10 shows a profile view of the Orange Street bridge and the possible grade change to the south approach.

A review of the signalized intersections on Orange Street adjacent to the bridge confirms the need for a 4-lane corridor and bridge.

The intersection of Orange, Front, and Main Streets was recently modified when Orange Street was widened. The intersection has a 4-lane road to the north and a 2-lane bridge to the south. The two south-bound lanes are required to merge into one lane between the intersection and the bridge. Figure No. 11 shows a schematic layout of the current intersection.

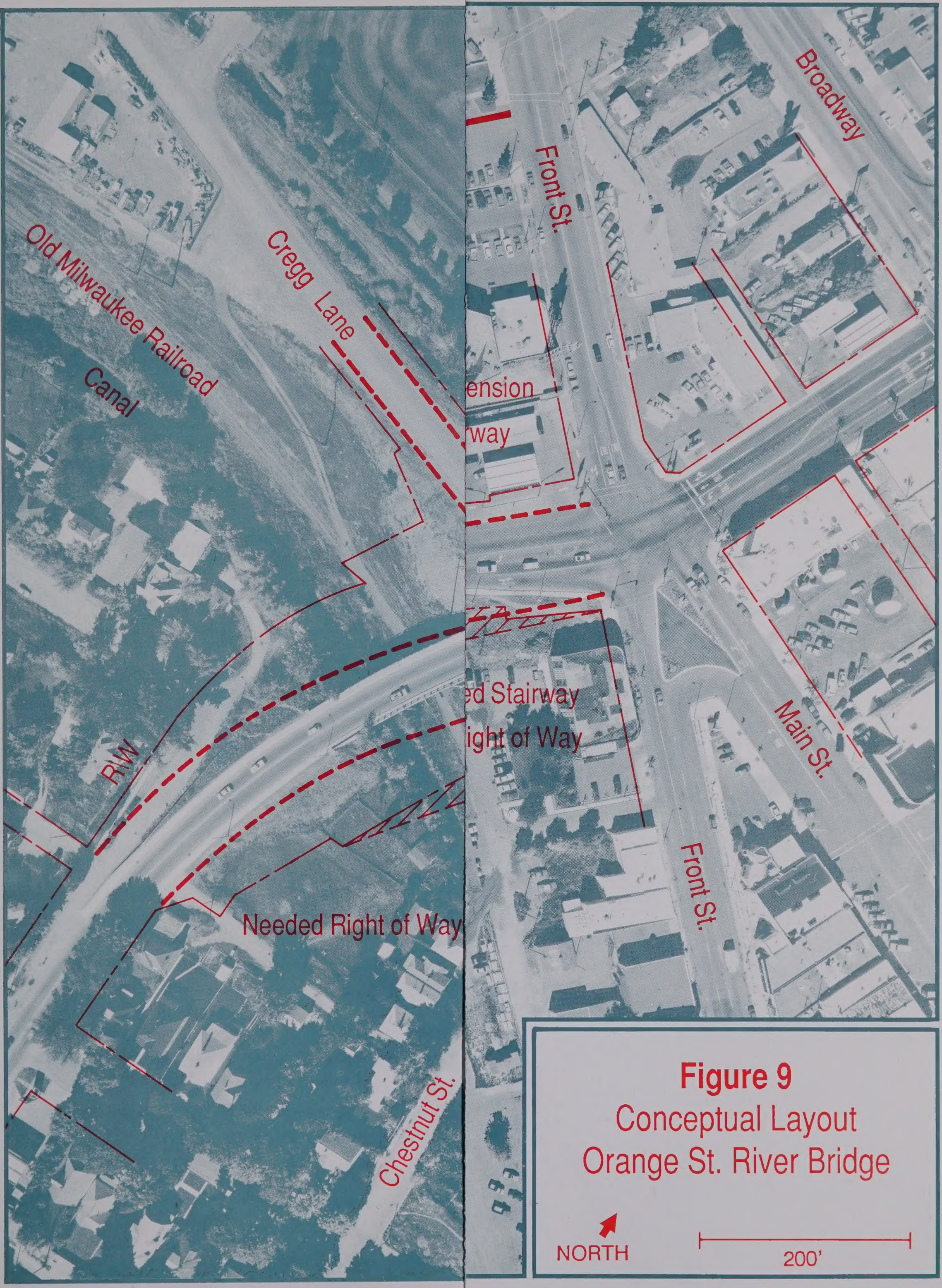
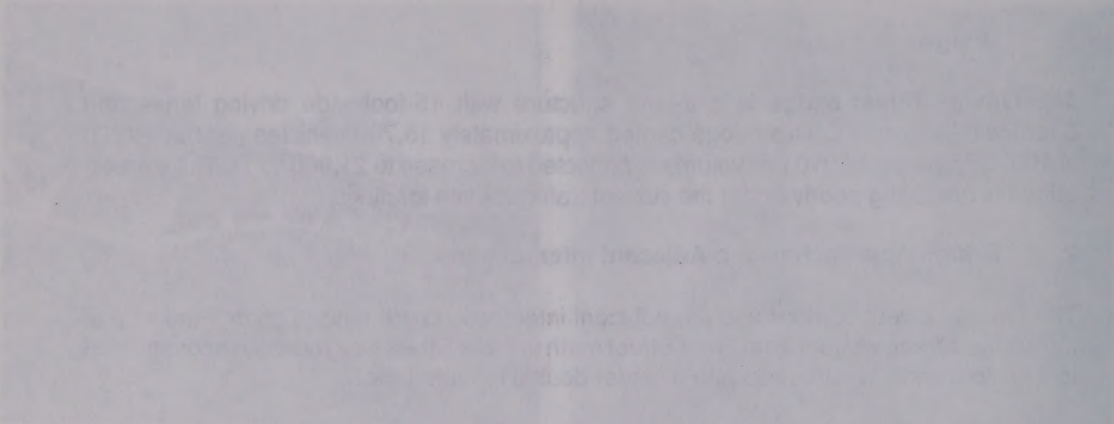
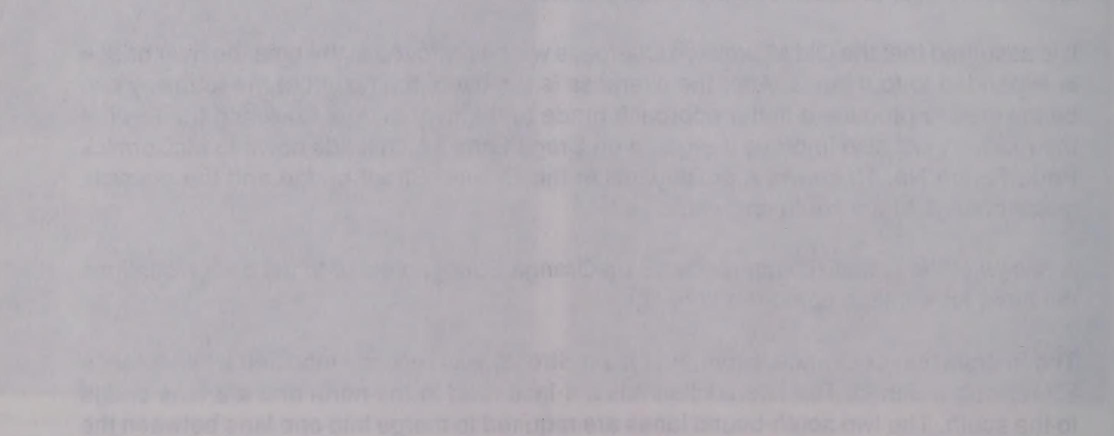
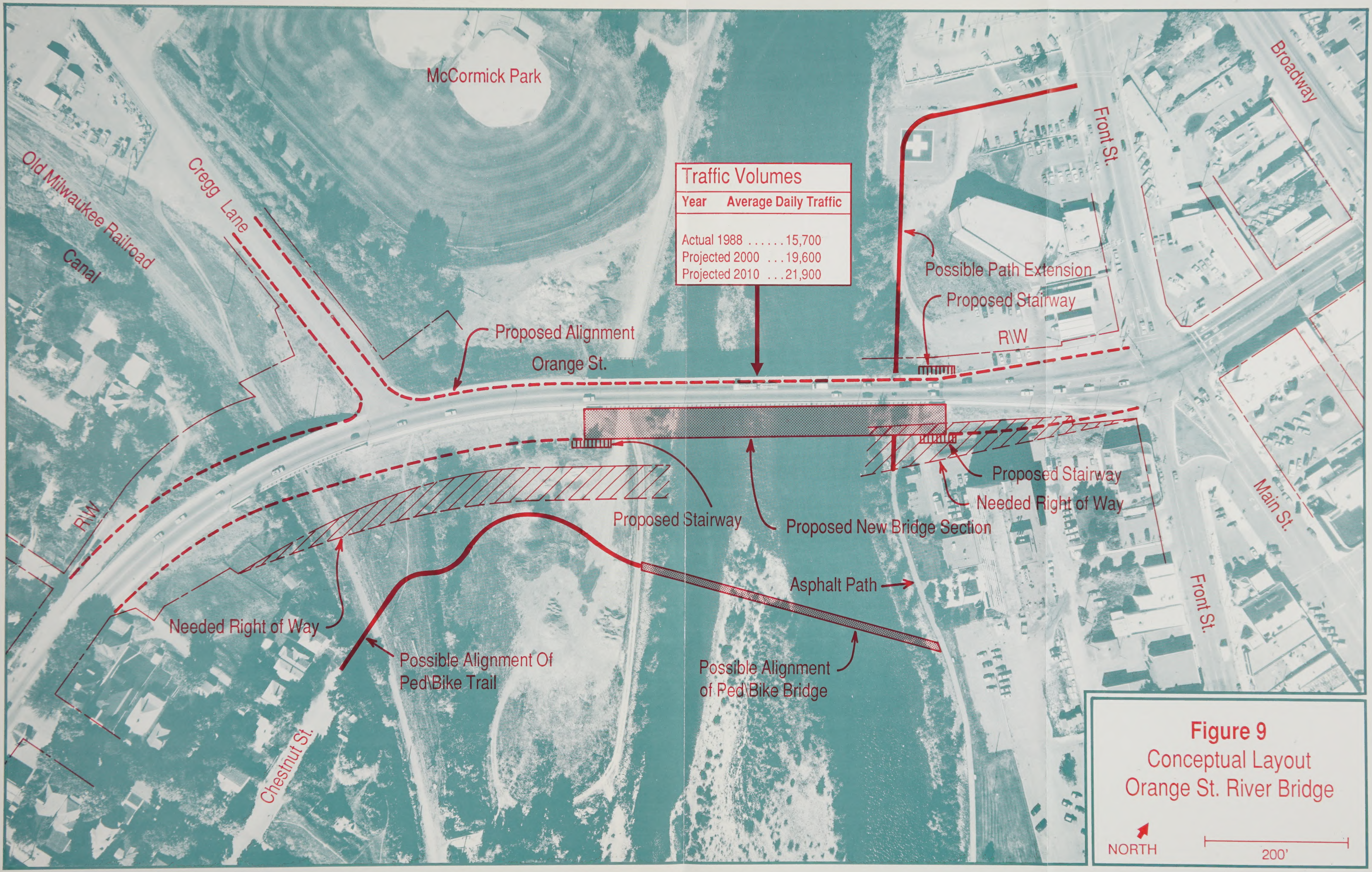

Broadway
Front St.
Cregg Lane
Old Milwaukee Railroad
Canal
ension
way
ed Stairway
ight of Way
R/W
Needed Right of Way
Main St.
Front St.
Chestnut St.
NORTH
200'

Figure 9
Conceptual Layout
Orange St. River Bridge

PHOTO PLATE NO. 4 - ORANGE STREET RIVER BRIDGE






McCormick Park
Old Milwaukee Railroad
Canal
Cregg Lane
Proposed Alignment
Orange St.
R\W
Possible Path Extension
Proposed Stairway
R\W
Broadway
Front St.
Proposed Stairway
Needed Right of Way
Proposed Stairway
Proposed New Bridge Section
Main St.
Asphalt Path
Needed Right of Way
Possible Alignment Of Ped\Bike Trail
Possible Alignment of Ped\Bike Bridge
Chestnut St.
Front St.
NORTH
200'

Traffic Volumes

Year	Average Daily Traffic
Actual 1988	15,700
Projected 2000	19,600
Projected 2010	21,900

Figure 9
Conceptual Layout
Orange St. River Bridge

Figure No. 10 - Profile View - Orange St. River Bridge

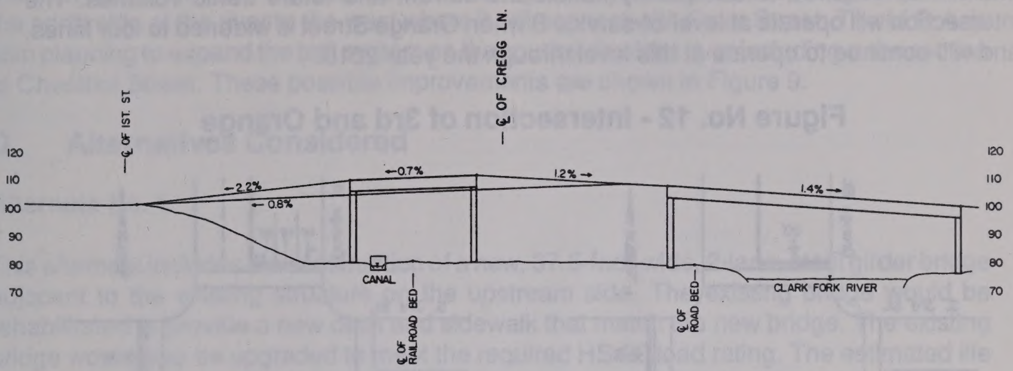
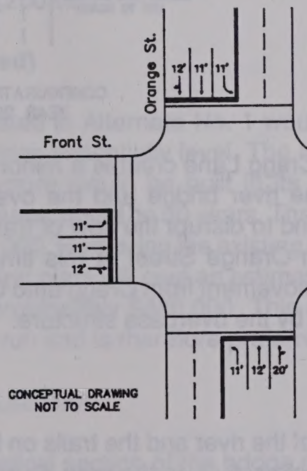

℄ OF 1ST. ST.
℄ OF CREGG LN.
120
110
100
90
80
70
−2.2%
← 0.8%
←0.7%
1.2% →
1.4% →
CANAL
℄ OF RAILROAD BED
℄ OF ROAD BED
CLARK FORK RIVER

Figure No. 11 - Intersection of Orange, Front, and Main

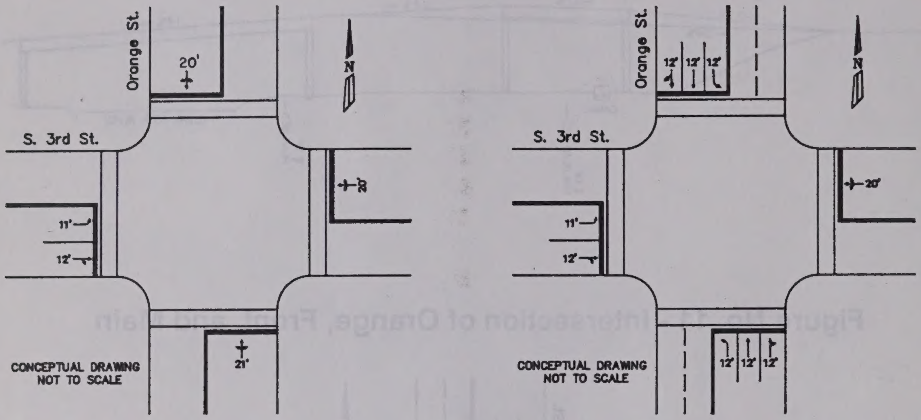

Orange St.
12'
11'
11'
N
Main St.
Front St.
14'
14'
11'
11'
12'
11'
12'
20'
CONCEPTUAL DRAWING
NOT TO SCALE

EXISTING CONFIGURATION

The intersection operates as if there is only one south-bound lane due to the far side merge. This intersection is currently operating at an unsatisfactory level-of-service E. If, in the near future, the bridge was widened to four lanes, thereby eliminating the merge condition, the intersection would operate at a satisfactory level-of-service C. This intersection configuration will provide an adequate level-of-service through the year 2010.

The intersection of 3rd and Orange Streets is also operating at an unsatisfactory level-of-service E. Figure No. 12 shows the current intersection configuration and the configuration that will be required to adequately handle the current and future traffic volumes. The intersection will operate at level-of-service B when Orange Street is widened to four lanes, and will continue to operate at this level through the year 2010.

Figure No. 12 - Intersection of 3rd and Orange



EXISTING CONFIGURATION

CONFIGURATION NEEDED FOR YEAR 2010 TRAFFIC

The intersection of Orange Street and Cregg Lane creates a minor operational problem. The intersection is located between the river bridge and the overpass structure. The left-turn movements into Cregg Lane tend to disrupt the flow of traffic on Orange Street. There is not enough roadway width on Orange Street at this time to accommodate a north-bound left turn lane. The left-turn movement from Cregg onto Orange is also difficult due to the limited sight distance caused by the overpass structure.

3. Pedestrians and Bicyclists

The McCormick Park on the south side of the river and the trails on both sides of the river tend to increase the pedestrian and bicycle activity in the area. Currently the only way for a pedestrian or bicyclist to travel down to the riverside park area, south of the bridge, is to use Cregg Lane. On the north side of the river, there is only a steep dirt path on the west side of the bridge that leads to the paved path that extends to the east along the river. It is desirable to provide some facilities that will enable the pedestrian and bicyclist to access these areas along the river. The addition of stairs on both sides of the north end of the bridge and on the upstream side of the south end will provide for pedestrian access.

The Missoula Redevelopment Agency (M.R.A.) is planning to make several possible improvements to the riverside area. Their plans include a pedestrian/bicycle bridge across the river upstream from the Orange Street bridge. They also plan to extend the path on the north side of the river to the west where it will connect with Front Street. The M.R.A. is also planning to expand the trail system on the south side of the river including a connection to Chestnut Street. These possible improvements are shown in Figure 9.

D. Alternatives Considered

Alternate No. 1

This alternate includes the construction of a new, 37.5-foot-wide, 2-lane, steel girder bridge adjacent to the existing structure on the upstream side. The existing bridge would be rehabilitated to provide a new deck and sidewalk that match the new bridge. The existing bridge would also be upgraded to meet the required HS-20 load rating. The estimated life of the structure would be at least 25 years for the truss and 50 years for the steel girder. The construction costs are estimated to be $2,210,000 for the new steel girder structure and $1,055,000 for the rehabilitation of the existing truss. Modifying the bridge approaches will cost approximately $935,000.

Total Estimated Cost: $4,200,000

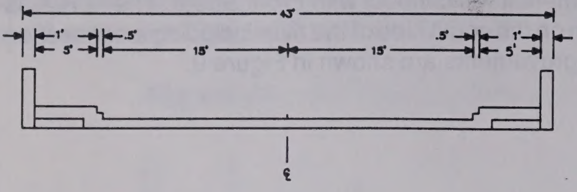
Alternate No. 2 (Preferred)

A new structure as indicated in Alternate No. 1 would be built with a lower grade at the south end making the bridge essentially level. The existing truss would be removed and another steel girder structure would be built in its place using the existing piers. The estimated life of the structures would be 50 years. The cost of the new steel girder structure is estimated to be $2,160,000. Removing the existing truss and constructing a second steel girder bridge on the existing piers will cost an estimated $1,780,000. Modifying the bridge approaches will cost approximately $880,000. This alternative is considered to be more cost effective in the long run and is therefore preferred over Alternate No. 1.

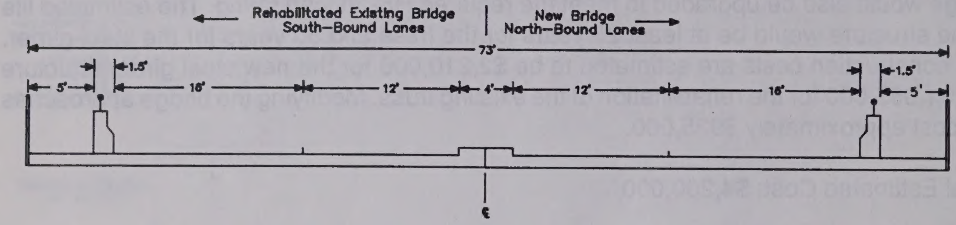
Total Estimated Cost: $4,820,000

Figure No. 13 shows a typical section of the bridge deck for the proposed structure. This section can be used on either alternative.

Figure No. 13 - Proposed Typical Section - Orange St. Bridge


43'
1'
5'
.5'
15'
15'
.5'
1'
5'
℄

EXISTING


Rehabilitated Existing Bridge South-Bound Lanes
New Bridge North-Bound Lanes
73'
1.5'
5'
16'
12'
4'
12'
16'
1.5'
5'
℄

PROPOSED

E. Recommended Improvements

1. Repair and Maintenance of Existing Bridge

This bridge is in fair condition, but it should be improved as soon as possible. This work should include providing water control at the bridge deck joints, repair of the concrete substructure, and the cleaning and painting of the truss members and bearing assemblies.

Estimated Cost: $135,000

2. Widen Bridge to Four Lanes (Alternate No. 1)

This work should be done in two phases. Phase 1 would involve constructing the new steel girder bridge. At the beginning of phase 2 the traffic would be shifted to the new bridge. The existing bridge would then be rehabilitated and the approaches modified.

Estimated Cost: $4,200,000

3. Improve Pedestrian and Bicyclist Facilities

Provide a 12-foot-wide paved path for combined pedestrian/bicyclist use along the toe of the fill on the east side of the south approach embankment. Also provide stairs on both sides of the north end of the bridge.

Estimated Cost: $30,000

Site 5
Orange Street
Montana Rail Link Underpass

SITE 5 - ORANGE STREET MONTANA RAIL LINK UNDERPASS

A. General Data

MDOH Bridge Number:	RU 08107 002+0.025-1
Features Crossed:	Montana Rail Link Railroad, Buildings, Railroad St. and N. 1st St.
Number of Traffic Lanes:	Two
Roadway Lighting:	Yes
Sidewalks:	5 feet both sides
Deck:	Varies
Width and Length:	30 feet by 395 feet
Number of Spans:	15 Separate structures
Substructure:	Concrete
Year Built:	1939
Rehabilitation:	None
Design Loading:	Designed for railroad loadings
MDOH Sufficiency Rating:	None

B. Summary of Structural Evaluation

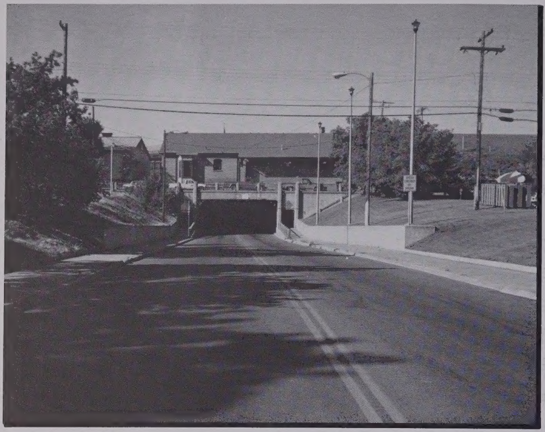
This underpass consists of 15 separate structures. There are two roadway concrete girder structures, two concrete girder structures supporting buildings, one steel girder supporting buildings, and 10 steel girder structures carrying rail lines and railroad access roads. The existing vertical clearance under these structures is 13 feet 6 inches. The current design standard for vertical clearance height is 16 feet.

There is considerable cracking and efflorescence in the concrete girders and deck and significant collision damage to the outside concrete girders (see Photo Plate No. 5). The concrete abutments have cracks and areas of spalling with exposed rebar.

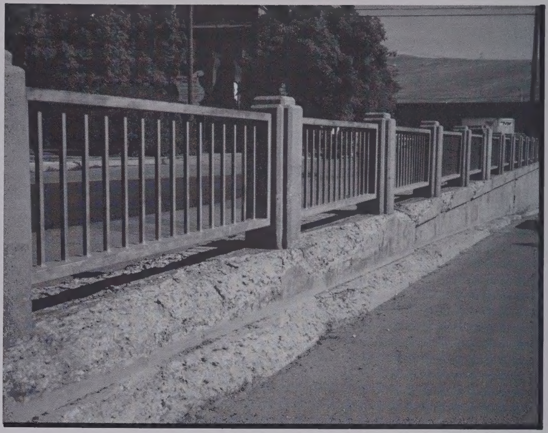
There is also collision damage to several of the steel girders. The steel girders have areas of moderate to heavy corrosion at joints where leakage occurs.

All structural members are functional but in need of major maintenance and rehabilitation.

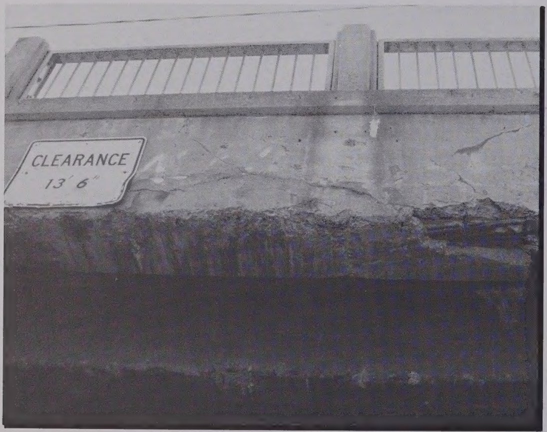
PHOTO PLATE NO. 5 - ORANGE STREET MONTANA RAIL LINK UNDERPASS



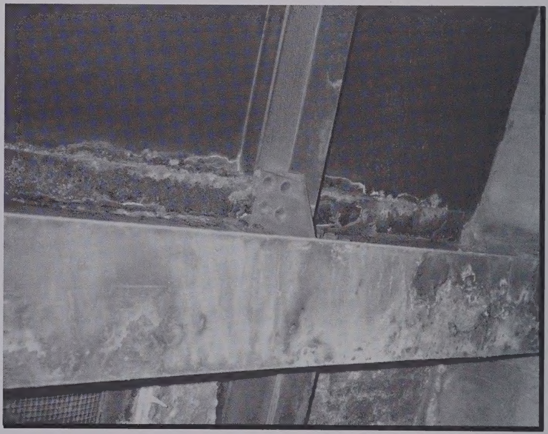
The Orange Street underpass was built in 1939 and is made up of 15 separate structures. The roadway goes under two city streets, two buildings and five sets of railroad track.



The concrete retaining wall and curb on the south approach show extensive concrete deterioration.



The low roadway clearance has resulted in numerous vehicle collisions with the exterior bridge beam.



Corrosion is evident along this steel girder. This deterioration is caused by water leaking through the deck joints.

The asphalt roadway is in generally good condition, although there are times when water ponds on the roadway during heavy rainstorms.

The roadway lighting is rather poor especially for pedestrians along the sidewalks.

C. Summary of Operational Analysis

The underpass carried approximately 11,600 vehicles per day (VPD) in 1988. This volume is projected to increase to 17,400 VPD by the year 2010.

The existing 2-lane underpass is adequately handling the current traffic volume, but it is expected to become a major bottleneck as traffic increases. The Orange Street corridor just south of the underpass was recently widened to a 4-lane facility creating a merge situation at the Alder Street intersection. Within the next several years, the entire Orange street corridor south of the underpass will be 4-lane. At that time it will be very desirable to extend the 4-lane section north to the Interstate.

The most significant problem with this underpass is the low clearance height. This limitation causes most of the large truck traffic to detour through the city to another acceptable crossing. Every year several trucks fail to clear the structure causing damage to the underpass and major traffic problems while the vehicle is being dislodged.

D. Alternatives Considered

Alternate No. 1

The existing underpass could be rehabilitated and deepened to provide an adequate vehicle clearance. At a later time, the underpass could be widened to a 4-lane facility. The rehabilitation and deepening of the existing structure is estimated to cost approximately $900,000. Unfortunately, widening the existing structure to four lanes is expected to cost between 6 and 8 million dollars, due to the special construction techniques required. A profile view of this alternative is presented in Figure No. 14.

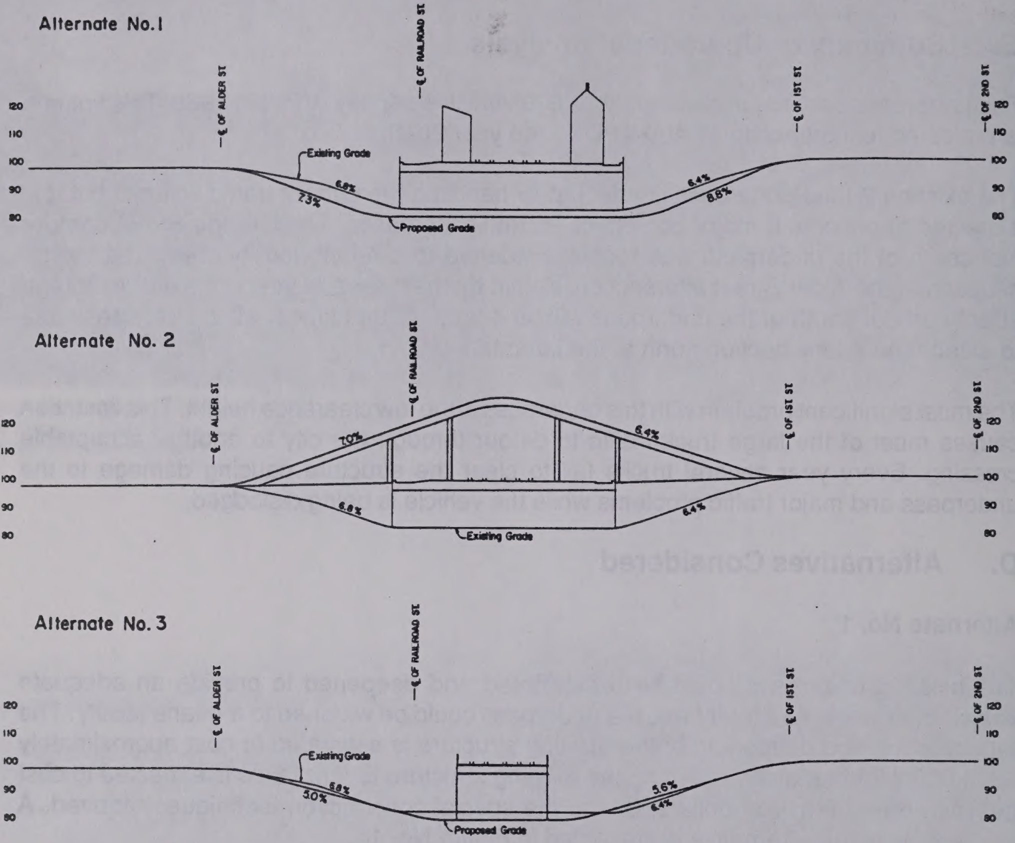
Estimated Cost: $ 7 to 9 Million

Alternate No. 2

The existing underpass could be filled in and a new 4-lane bridge constructed over the two city streets and the railroad tracks. The two buildings would have to be purchased and removed. The grades on the bridge would be approximately 7% and the approaches would end prior to the adjacent intersections (see Figure No. 14).

Estimated Cost: $5.7 Million

Figure No. 14 - Alternatives Considered - Orange St. Underpass


Alternate No. 1
℄ OF ALDER ST
℄ OF RAILROAD ST
℄ OF 1ST ST
℄ OF 2ND ST
120
110
100
90
80
Existing Grade
6.8%
7.3%
6.4%
8.8%
Proposed Grade
Alternate No. 2
7.0%
6.4%
6.8%
6.4%
Existing Grade
Alternate No. 3
Existing Grade
5.0%
6.8%
5.6%
6.4%
Proposed Grade

Alternate No. 3

This alternate involves purchasing the two buildings and removing them, closing the two city streets and constructing a new 4-lane underpass. The structure would be only 165-feet-long since it only has to go under the five sets of railroad tracks. The existing underpass is 395-feet-long. The closing of Railroad Street and North 1st Streets will not create any major traffic circulation problems.

Estimated Cost: $4.2 Million

Mr. Charles Chambers, Assistant Chief Engineer for the Montana Rail Link, was contacted during the course of the selection and evaluation of the alternatives. He indicated that all three of the alternatives are acceptable to Rail Link. He did not specify any preference in the alternatives.

The consultant prefers Alternate No. 3 due to its relative low cost and ease of implementation. A conceptual layout of the 165 -foot-long underpass is shown in Figure No. 15. No additional right-of-way will be required to accomodate the proposed 4-lane underpass.

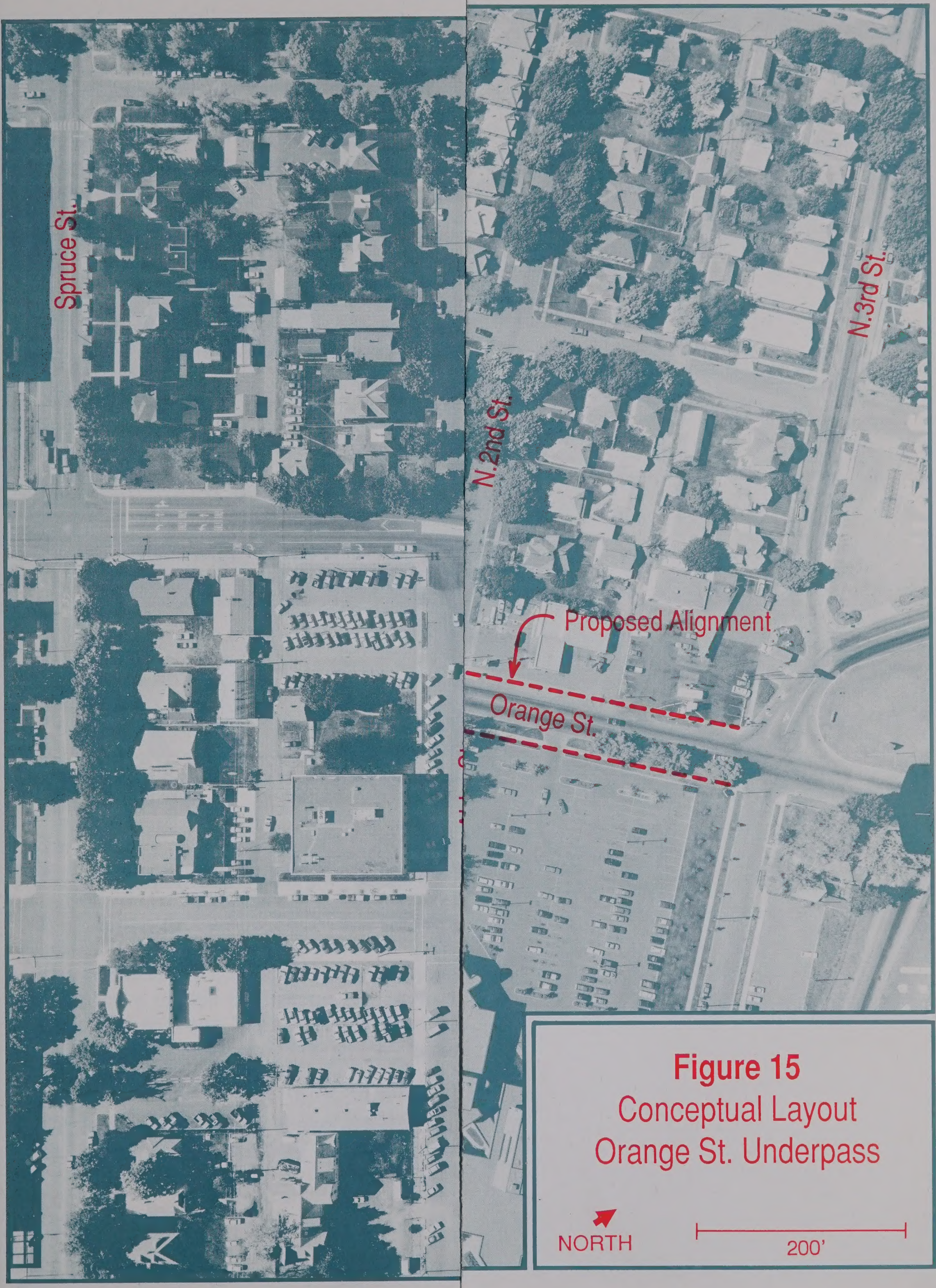
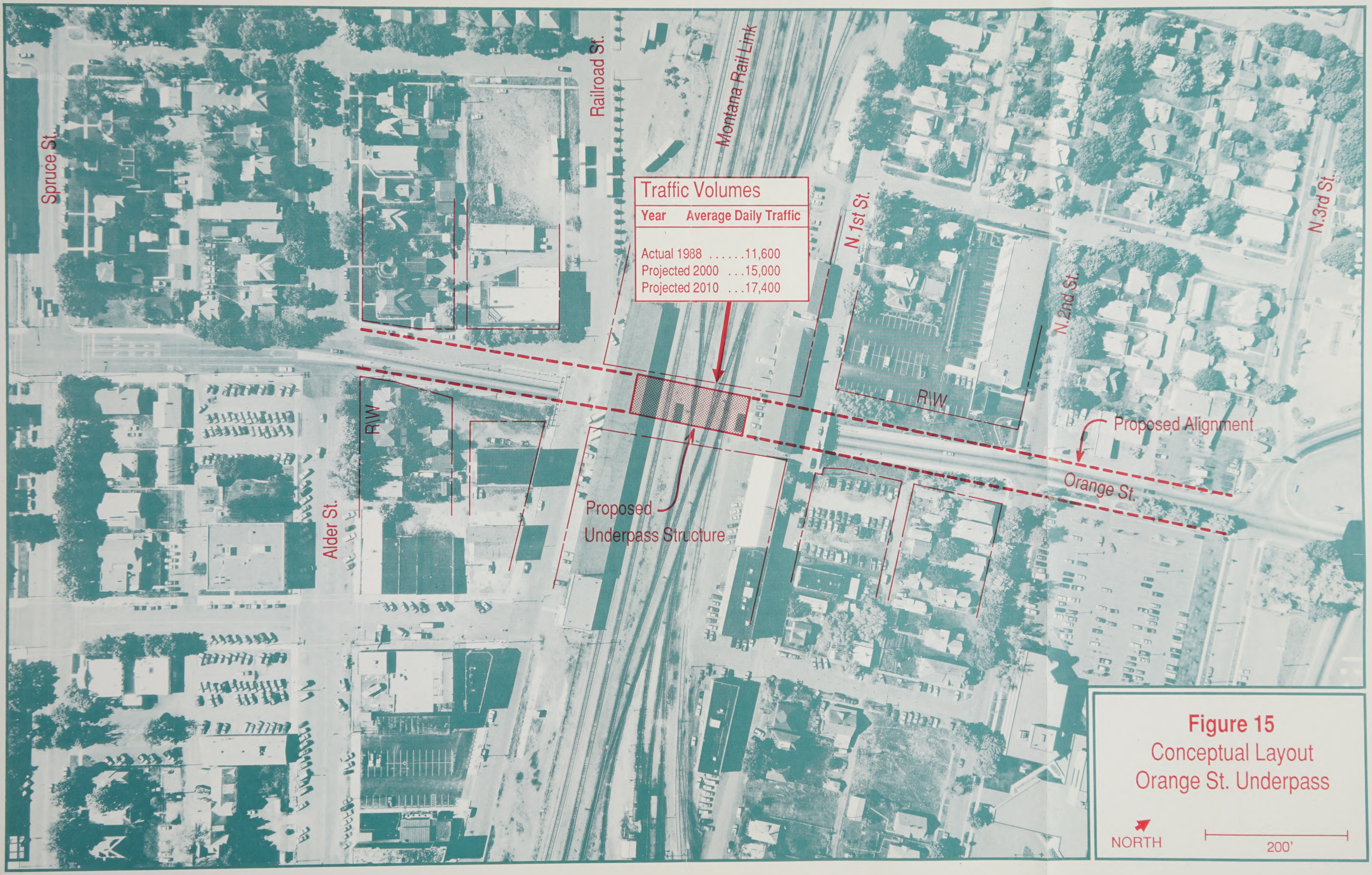

Spruce St.
N.2nd St.
N.3rd St.
Proposed Alignment
Orange St.
NORTH
200'

Figure 15
Conceptual Layout
Orange St. Underpass


Spruce St.
Railroad St.
Montana Rail Link
N.1st St.
N.2nd St.
N.3rd St.
Alder St.
R/W
R/W
Proposed Alignment
Orange St.
Proposed Underpass Structure
NORTH
200'

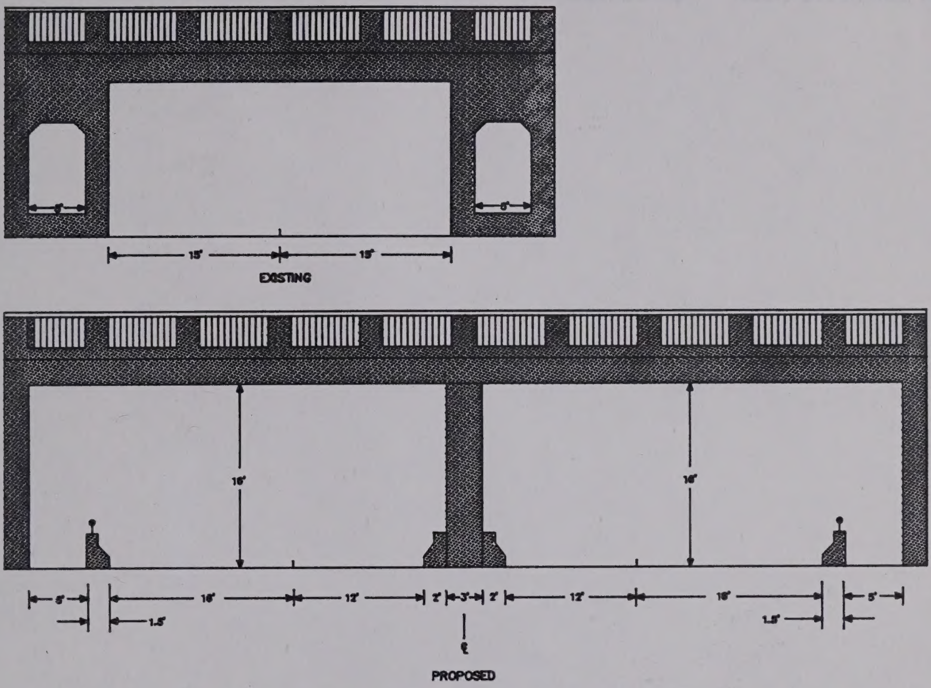
Traffic Volumes

Year	Average Daily Traffic
Actual 1988	11,600
Projected 2000	15,000
Projected 2010	17,400

Figure 15
Conceptual Layout
Orange St. Underpass

The proposed typical section for the new underpass is shown in Figure No. 16. This roadway section will transition well with the 60-foot-wide section of the adjacent roadway on Orange Street. The 12-foot center left turn lane would be dropped at the nearest intersection, and replaced by a center median that leads to the center support of the underpass structure.

Figure No. 16 - Proposed Typical Section - Orange St. Underpass



E. Recommended Improvements

1. Construct a New Four-Lane Underpass (Alternate No. 3)

This improvement consists of the purchase and removal of the two buildings, closing and removing a portion of Railroad and North 1st Streets, and constructing a new 4-lane underpass structure. The new structure would be approximately 165 feet of underpass and 780 feet of retaining wall. The 4-lane structure would be realigned slightly in the same general location.

This improvement can be implemented in two phases. Phase I would include the purchase and removal of the buildings, closing and removing Railroad and North 1st Streets, and removing all of the excess structure. This would leave only the railroad crossing over Orange Street.

Phase II would involve removing the existing retaining wall and railroad crossing structure and constructing a new 4-lane underpass.

Estimated Cost Phase I: $650,000
Estimated Cost Phase II: $3,600,000
Total Estimated Cost: $4.25 million

Site 6

Russell Street Railroad Underpass

SITE 6 - RUSSELL STREET RAILROAD UNDERPASS

A. General Data

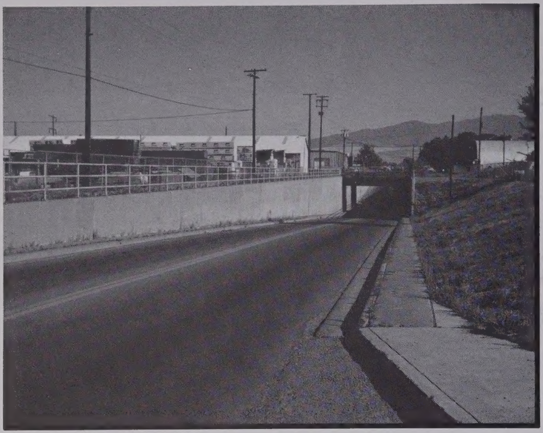
MDOH Bridge Number:	RU 08105 002+0.477-1
Features Crossed:	Montana Rail Link siding and local access road
Number of Traffic Lanes:	Two
Roadway Lighting:	No
Sidewalks:	3-feet-wide both sides
Deck:	Concrete roadway and railroad crossings
Width and Length:	34 feet by 793 feet
Number of Spans:	One
Substructure:	Concrete Retaining Wall
Year Built:	1965
Rehabilitation:	None
Design Loading:	Designed for railroad loadings
MDOH Sufficiency Rating:	None

B. Summary of Structural Evaluation

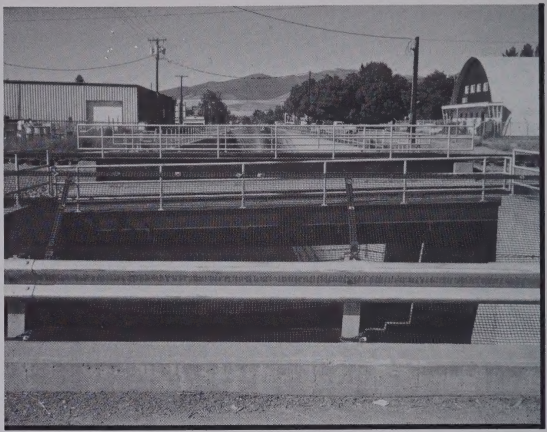
This underpass consists of three structures over the roadway. One is a concrete girder bridge carrying an access road. The other two are steel girder railroad bridges, for the Montana Rail Link sidings. There is significant collision damage to the concrete roadway bridge, but it is still serviceable (see Photo Plate No. 6). The two railroad structures are in good condition. The roadway clearance under these structures is 14 feet 4 inches.

The large retaining walls along the roadway are cracked and have some spalling. They are in good condition and functioning properly. There are frequent problems with water building up in the underpass during heavy rainstorms, sometimes requiring a traffic detour.

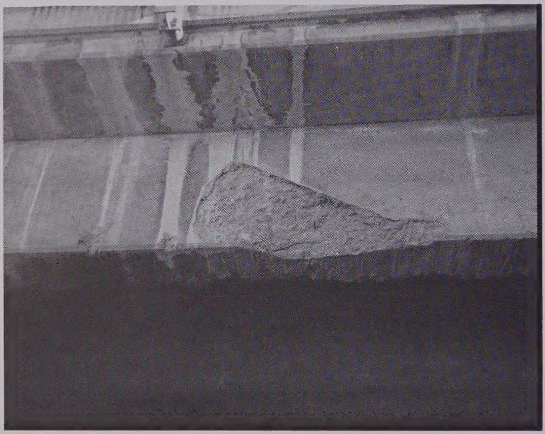
PHOTO PLATE NO. 6 - RUSSELL STREET RAILROAD UNDERPASS



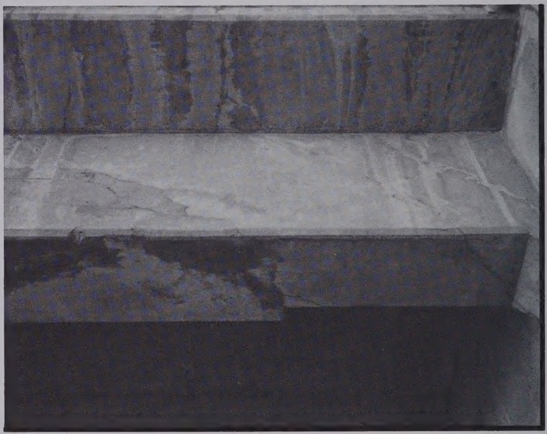
Russell Street, at the railroad underpass, consists of two 15-foot-wide driving lanes with 3-foot-wide sidewalks on both sides.



The underpass is actually three separate structures. This photo was taken from the roadway bridge looking north at the two railroad structures.



Vehicle collisions have resulted in the loss of a portion of the concrete girder.



This concrete girder, which was previously rebuilt and thickened, has been damaged again from vehicle collisions.

C. Summary of Operational Analysis

1. Underpass Structure

Approximately 18,500 vehicles per day (VPD) used this two lane underpass in 1988. Traffic volumes at this location are projected to increase to over 24,000 VPD by the year 2010.

The Russell Street corridor is in need of widening to four lanes to adequately handle the current traffic volumes. The underpass structure will need to be widened or removed when Russell Street is upgraded. Figure No. 17 shows a conceptual layout of the future four-lane roadway in the area of the underpass. No additional right-of-way will be required to accomodate the four lane roadway. Figure No. 18 shows a proposed temporary 2-lane roadway and the ultimate 4-lane facility.

2. Adjacent Intersections

To verify the need for a 4-lane facility on this portion of Russell Street one must evaluate the effectiveness of the adjacent intersections. The signalized intersection at 3rd and Russell is four blocks south of the underpass and will tend to control the size of the roadway in this area.

The 3rd and Russell intersection is currently operating at an unacceptable level-of-service E. If the Russell Street corridor was widened to four lanes, the intersection would provide an acceptable level-of-service C through the year 2000. By the year 2010, additional traffic increases on S. 3rd Street will require that it be expanded to a 4-lane roadway west of the Russell Street intersection.

The existing intersection configuration and the future intersection requirements are presented in Figure No. 19.

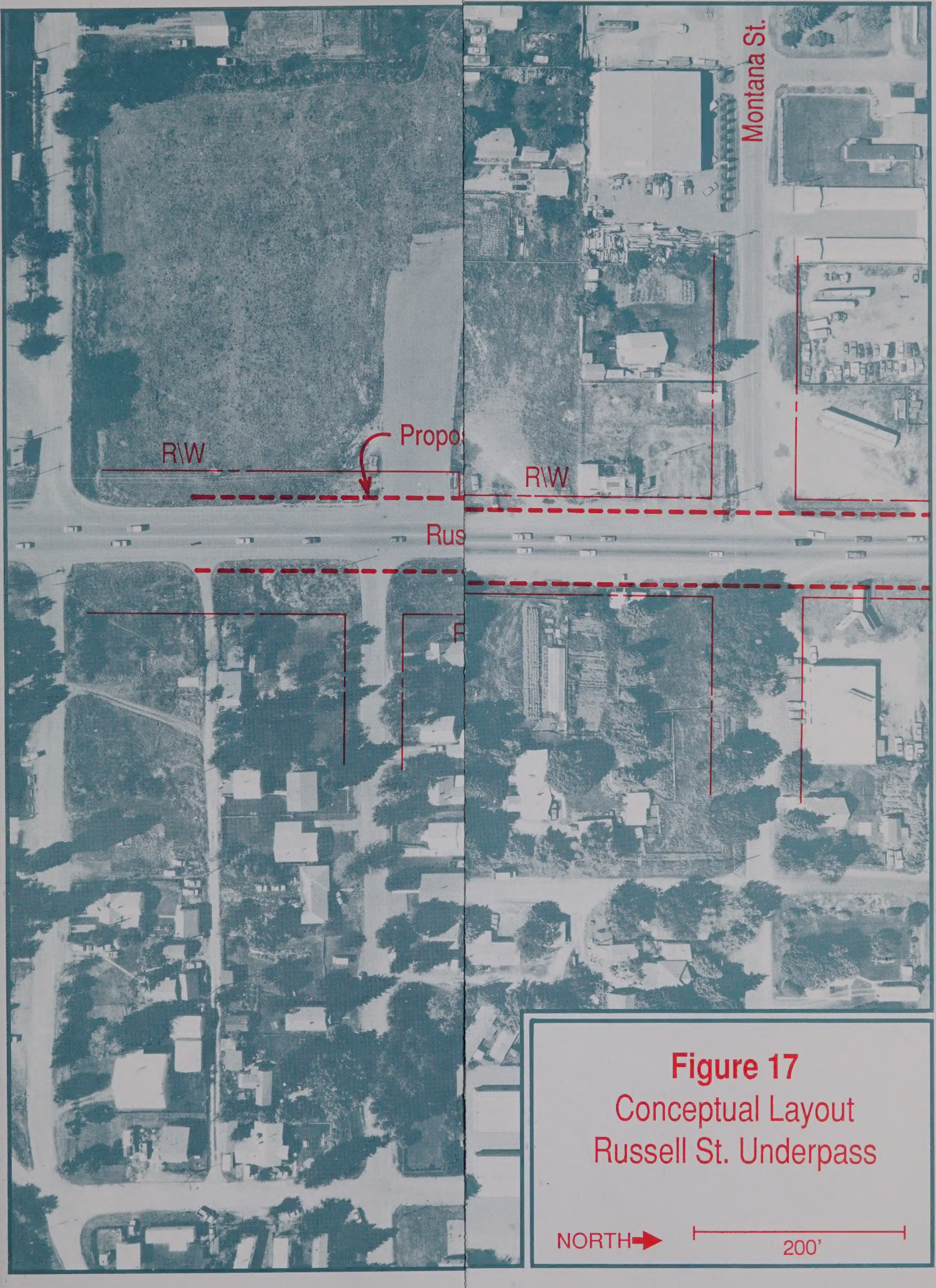
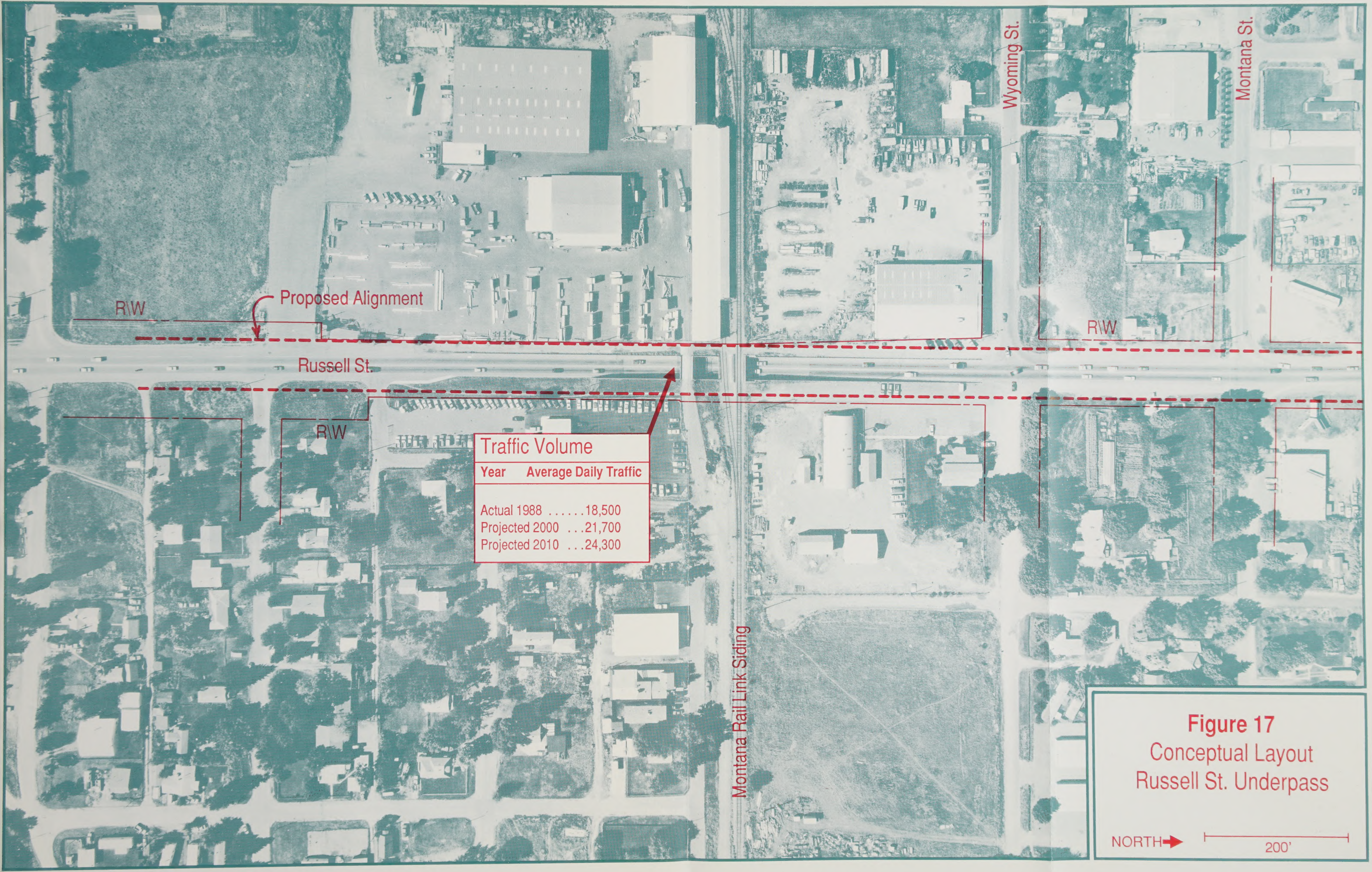

Montana St.
R\W
Propo
R\W
Rus
R
NORTH
200'

Figure 17
Conceptual Layout
Russell St. Underpass


Wyoming St.
Montana St.
R\W
Proposed Alignment
Russell St.
R\W
R\W
Montana Rail Link Siding
NORTH
200'

Traffic Volume

Year	Average Daily Traffic
Actual 1988	18,500
Projected 2000	21,700
Projected 2010	24,300

Figure 17
Conceptual Layout
Russell St. Underpass

Figure No. 18 - Proposed Typical Section - Russell St. Underpass

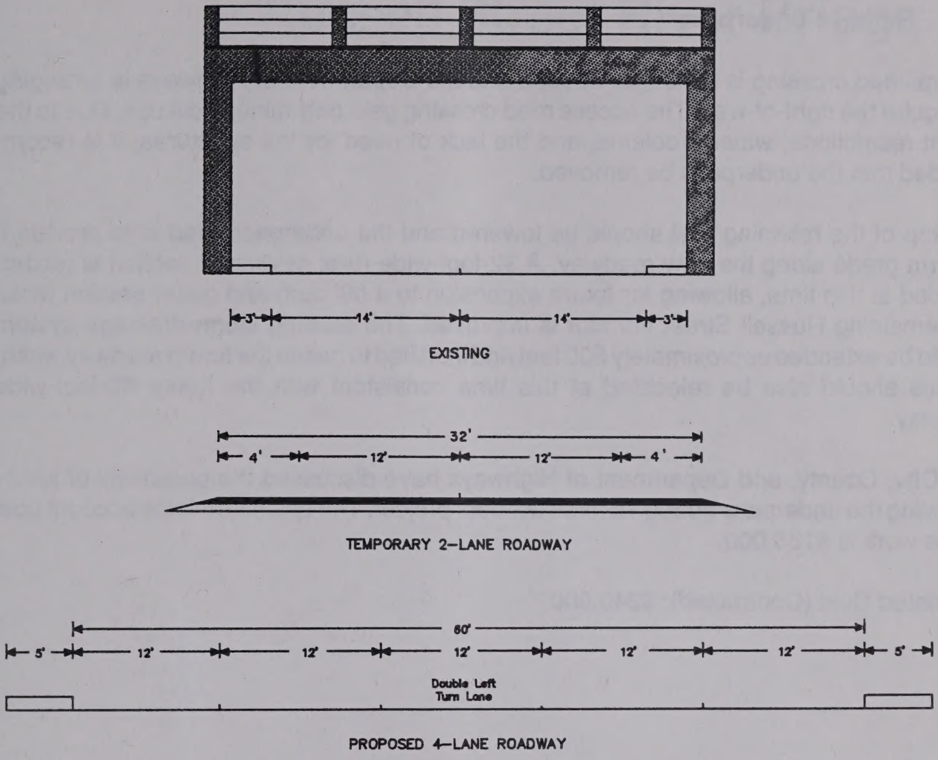
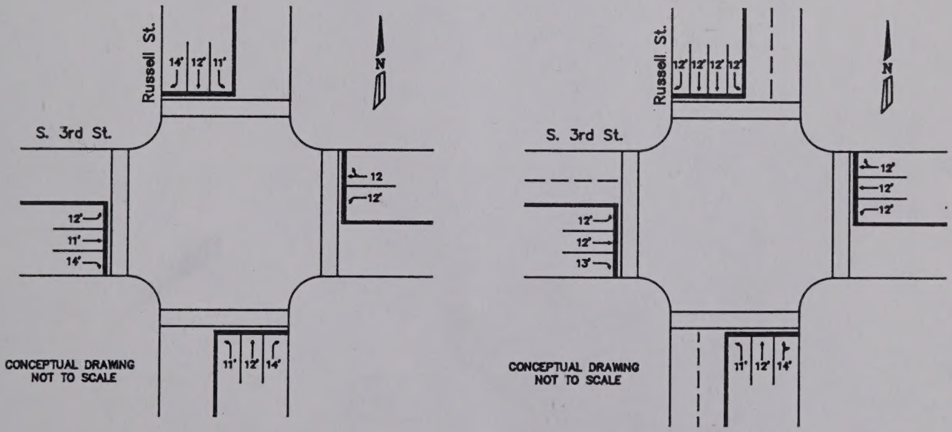

3'
14'
14'
3'
EXISTING
32'
4'
12'
12'
4'
TEMPORARY 2–LANE ROADWAY
60'
5'
12'
12'
12'
12'
12'
5'
Double Left Turn Lane
PROPOSED 4–LANE ROADWAY

Figure No. 19 - Intersection of 3rd and Russell


Russell St.
14'
12'
11'
N
S. 3rd St.
12
12'
12'
11'
14'
11'
12'
14'
CONCEPTUAL DRAWING NOT TO SCALE
Russell St.
12'
12'
12'
12'
N
S. 3rd St.
12'
12'
12'
12'
12'
13'
11'
12'
14'
CONCEPTUAL DRAWING NOT TO SCALE

EXISTING CONFIGURATION

CONFIGURATION NEEDED FOR YEAR 2010 TRAFFIC

D. Recommended Improvements

1. Remove Underpass

The railroad crossing is no longer needed and the Department of Highways is arranging to acquire the right-of-way. The access road crossing gets only minor local use. Due to the height restrictions, water problems, and the lack of need for the structures, it is recommended that the underpass be removed.

The top of the retaining wall should be lowered and the underpass filled in to provide a uniform grade along the new roadway. A 32-foot-wide rural pavement section is recommended at this time, allowing for future expansion to a 60' curb and gutter section when the remaining Russell Street corridor is improved. The existing storm drainage system should be extended approximately 500 feet and installed to match the future roadway width. Utilities should also be relocated at this time consistent with the future 60-foot-wide roadway.

The CIty, County, and Department of Highways have discussed the possibility of jointly removing the underpass through a force account project. The estimated force account cost of this work is $186,000.

Estimated Cost (Contracted): $240,000

Site 7
Russell Street River Bridge

SITE 7 - RUSSELL STREET RIVER BRIDGE

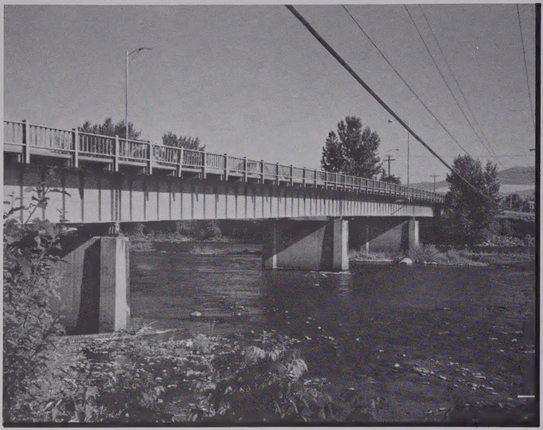
A. General Data

MDOH Bridge Number:	U 08105 002+0.804-1
Features Crossed:	Clark Fork River
Number of Traffic Lanes:	Two
Roadway lighting:	Yes
Sidewalks:	4-feet-wide both sides
Deck:	Concrete with asphalt overlay
Width and Length:	32 feet by 420 feet
Number of Spans:	4 Main - riveted steel plate girders
Substructure:	Concrete piers and bents on spread footings
Year Built:	1957
Rehabilitation:	None
Design Loading:	HS-20
MDOH Sufficiency Rating:	57.7

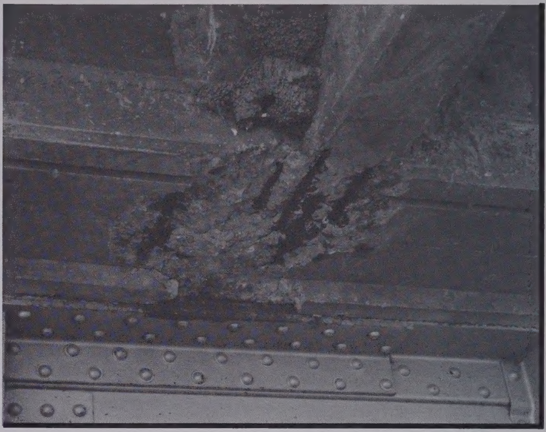
B. Summary of Structural Evaluation

The overall condition of the bridge is fair. It does, however, have significant deficiencies. The deck has a recent asphalt pavement overlay producing a good driving surface, but cracking and efflorescense visible on the bottom of the deck indicates some probable delamination and reinforcing corrosion. Leaking deck joints have also resulted in moderate steel girder and bearing corrosion near the supports (see Photo Plate No. 7). The bridge and approach guardrails have some unrepaired vehicle damage and lack continuity that current standards require.

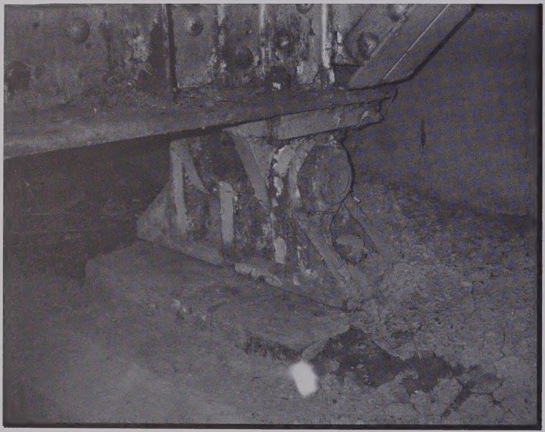
PHOTO PLATE NO 7 - RUSSELL STREET RIVER BRIDGE



The Russell Street Bridge has four main spans consisting of riveted steel plate girders with concrete piers and bents on spread footings. The bridge is 420 feet long and was built in 1957.



This deck-sidewalk connection has been weakened by spalling concrete and corrosion of the exposed rebar.



The extensive corrosion of this bearing shoe is the result of water leaking through the deck joint above.

The approach guardrail south of the bridge has not been repaired since it was damaged by a vehicle collision.

C. Summary of Operational Analysis

1. Bridge

In 1988, the Russell Street bridge carried approximately 19,500 vehicles per day. By the year 2010, this bridge will have to carry over 24,500 vehicles per day. The existing structure is not able to adequately handle the current traffic volumes.

The bridge expansion will most likely be in the form of a new structure built adjacent to the existing bridge. A review of the layout of the existing bridge and the alignment of the roadway indicates that the new structure will fit best on the upstream side of the existing structure. Figure No. 20 shows the existing right-of-way and the proposed location of the new bridge. Some additional right-of-way will be required for the 4-lane structure and the approach modifications.

2. Adjacent Intersections

The intersection of Broadway and Russell is currently operating at level-of-service E. The large volume of left turning vehicles on the east approach requires two left turn lanes. This can not be accomplished until the bridge is widened to four lanes. When the bridge is widened the improved intersection will function at an acceptable level-of-service through the year 2010. Figure No. 21 shows the existing intersection configuration and the intersection required to handle the current and future traffic volumes.

D. Alternatives Considered

The logical procedure for the widening of this bridge involves building a new structure for the north-bound traffic lanes and rehabilitating the existing bridge to carry the south-bound traffic. The upstream side of the existing bridge is the best fit for the new structure. The proposed typical section for the new 4-lane bridge is presented in Figure No. 22. The section includes two 5-foot sidewalks, a 4-foot concrete center median, two 12-foot-wide inside lanes and two 16-foot-wide outside driving lanes.

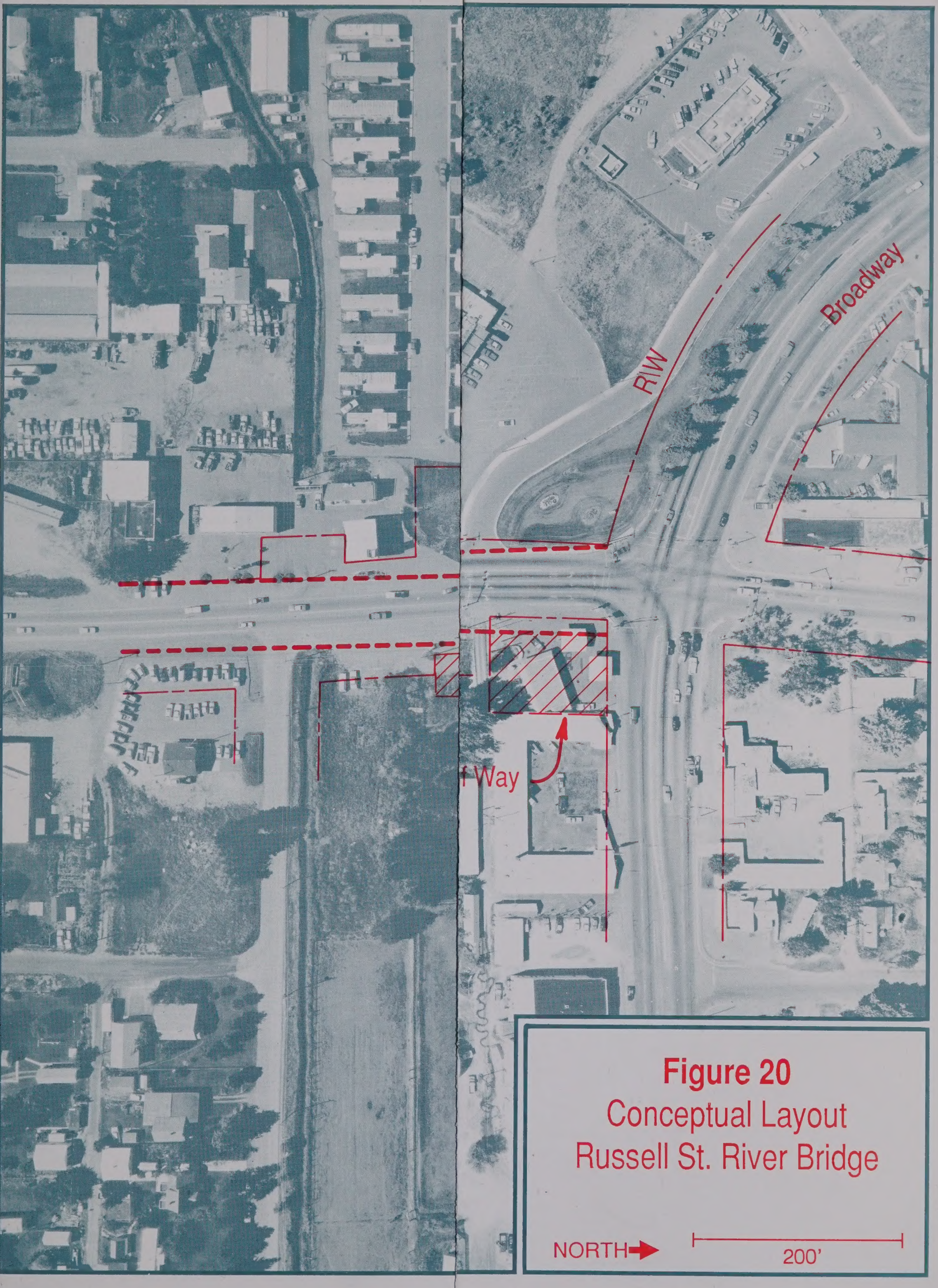
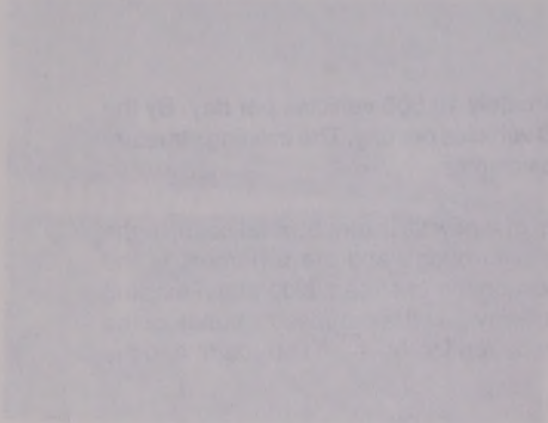
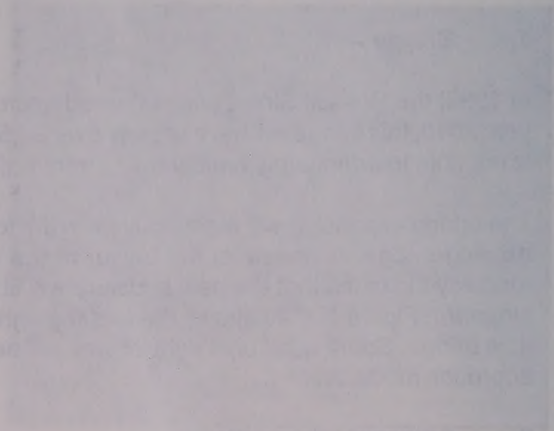

R/W
Broadway
f Way
NORTH
200'

Figure 20
Conceptual Layout
Russell St. River Bridge

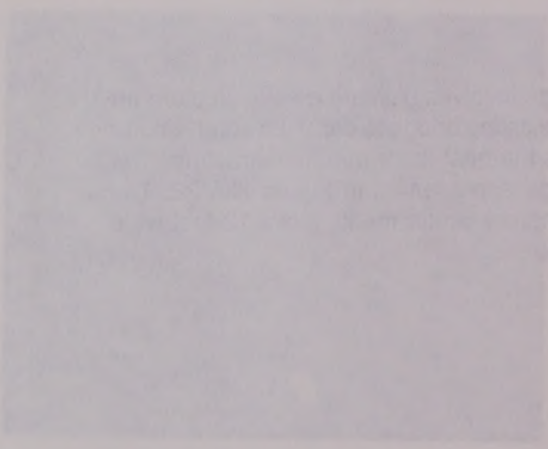
PHOTO PLATE NO 7 - RUSSELL STREET RIVER BRIDGE



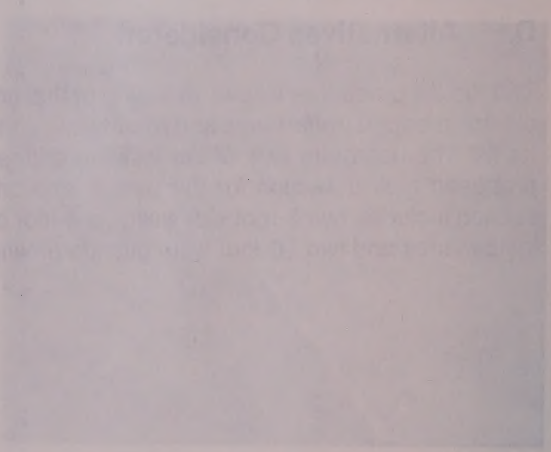
[illegible]



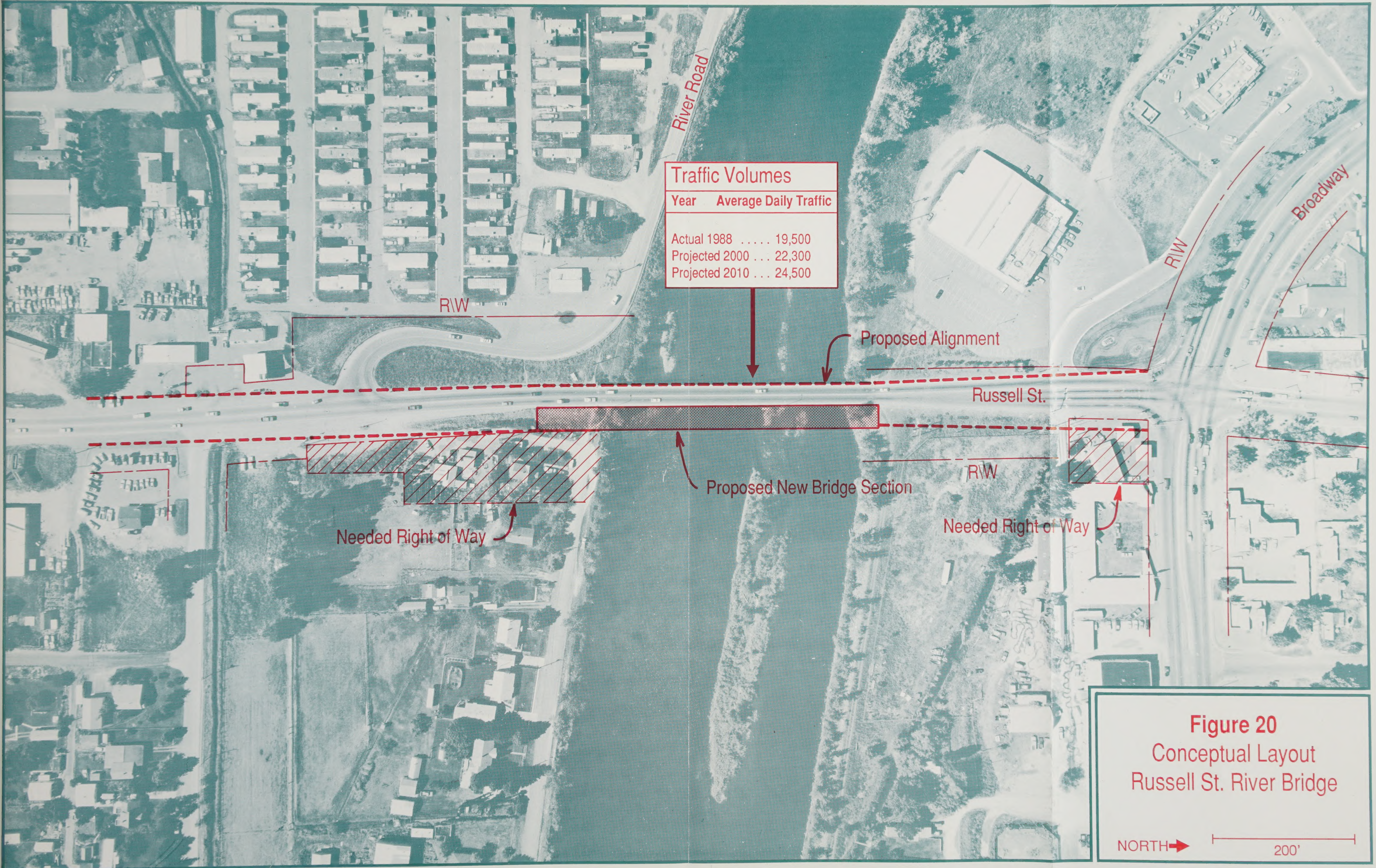
[illegible]



[illegible]



[illegible]

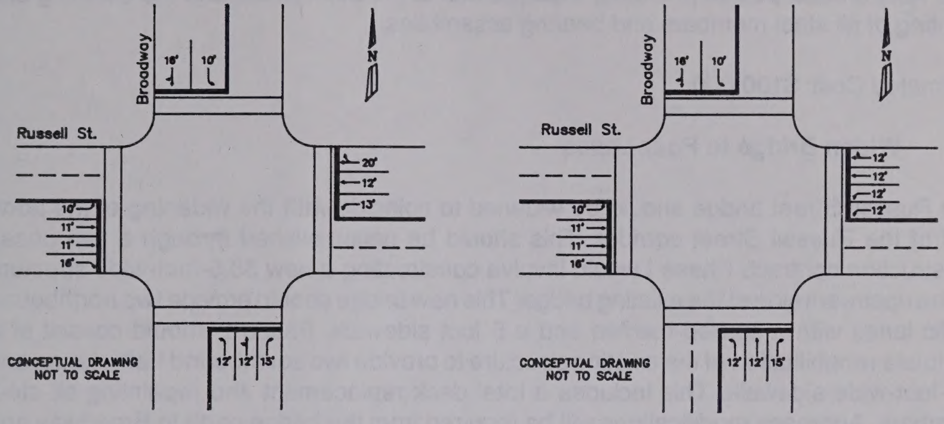

River Road
R/W
Proposed Alignment
Russell St.
Broadway
R/W
R/W
Proposed New Bridge Section
Needed Right of Way
Needed Right of Way
NORTH
200'

Traffic Volumes

Year	Average Daily Traffic
Actual 1988	19,500
Projected 2000	22,300
Projected 2010	24,500

Figure 20
Conceptual Layout
Russell St. River Bridge

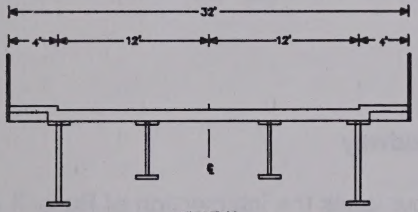
Figure No. 21 - Intersection of Russell and Broadway


Broadway
16'
10'
N
Russell St.
20'
12'
13'
10'
11'
11'
16'
12'
12'
15'
CONCEPTUAL DRAWING
NOT TO SCALE
Broadway
16'
10'
N
Russell St.
12'
12'
12'
12'
10'
11'
11'
16'
12'
12'
15'
CONCEPTUAL DRAWING
NOT TO SCALE

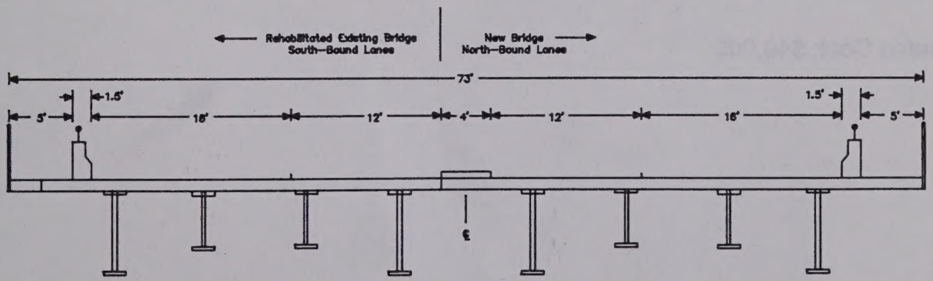
EXISTING CONFIGURATION

CONFIGURATION NEEDED FOR
YEAR 2010 TRAFFIC

Figure No. 22 - Proposed Typical Section - Russell St. River Bridge



EXISTING


Rehabilitated Existing Bridge
South-Bound Lanes
New Bridge
North-Bound Lanes
73'
1.5'
1.5'
5'
16'
12'
4'
12'
16'
5'
℄

PROPOSED

E. Recommended Improvements

1. Repair and Maintenance of Existing Bridge

This work should include providing water control at the deck joints, and the cleaning and painting of all steel members and bearing assemblies.

Estimated Cost: $100,000

2. Widen Bridge to Four Lanes

The Russell Street bridge should be widened to coincide with the widening of the north end of the Russell Street corridor. This should be accomplished through a two phase construction contract. Phase I would involve constructing a new 38.5-foot-wide structure on the upstream side of the existing bridge. This new bridge should provide two northbound traffic lanes with a curbed median and a 5 foot sidewalk. Phase 2 should consist of a complete rehabilitation of the existing structure to provide two southbound traffic lanes and a 5-foot-wide sidewalk. This includes a total deck replacement and repainting all steel members. Approach modifications will be required from the bridge north to Broadway and south to Idaho Street.

This project will extend the useful life of the existing bridge at least fifty years.

The estimated cost of the new bridge is $1,810,000. The rehabilitation of the existing bridge will cost approximately $770,000. The modifications to the bridge approaches will cost an estimated $590,000.

Estimated Cost: $3,170,000

3. Modify Intersection of Russell and Broadway

When the Russell Street bridge is widened to four lanes the intersection of Russell and Broadway should be modified. This modification to include two left turn lanes on the east approach and two exit lanes leading south of the intersection.

Estimated Cost: $40,000

Site 8
Reserve Street Overpass at West Broadway

SITE 8 - RESERVE STREET OVERPASS AT WEST BROADWAY

A. General Data

MDOH Bridge Number:	P 00071 001+0.017-1
Features Crossed:	West Broadway and Montana Rail Link
Number of Traffic Lanes:	Two
Roadway Lighting:	Yes
Sidewalks:	None
Deck:	Concrete with asphalt overlay
Width and Length:	35 feet by 485 feet
Number of Spans:	4 Main - welded steel girders
Substructure:	Concrete bents on spread footings
Year Built:	1968
Rehabilitation:	Minor deck patching prior to overlay in 1987
Design Loading:	HS-20
MDOH Sufficiency Rating:	74.2

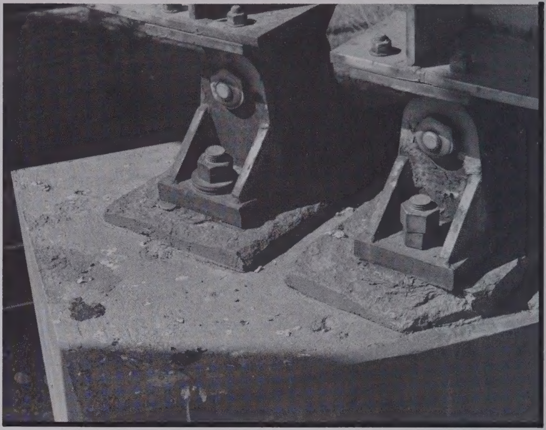
B. Summary of Structural Evaluation

This bridge is in fair condition although there are some deficiencies. The deck has had a recent asphalt overlay producing a good riding surface. Previous reports indicated that the deck had a considerable amount of spalling and delamination with some rebar exposed. These deck pot-holes were patched prior to the asphalt overlay. Only a minor amount of efflorescence is visible on the bottom of the deck.

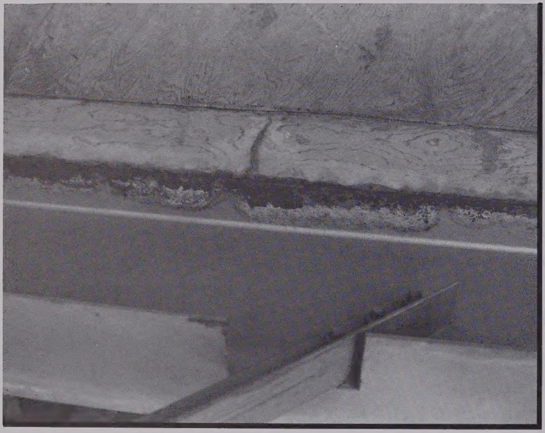
The deck joints are leaking and causing some rusting of the girders and bearing assemblies (see Photo Plate No. 8).

PHOTO PLATE NO. 8 - RESERVE STREET OVERPASS

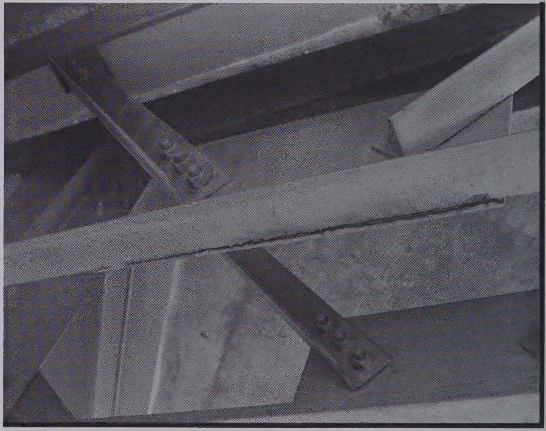
The Reserve Street overpass was construced in 1968. The structure is 484 feet long and carries traffic over West Broadway and the Montana Rail Link tracks.



Deck joint leakage deteriorated these bearing pads and corroded the bearing assemblies.



The top edge of this beam flange shows evidence of extensive corrosion damage.



The welds on this brace plate connection have broken due to the pressure caused by the corrosion of the steel members.

The approach guardrails are not fastened to the bridge railings as required by current design standards.

C. Summary of Operational Analysis

The Reserve Street corridor is the principal north-south arterial route on the west side of Missoula. Reserve is a 2-lane roadway with some pavement widening at major intersections.

The overpass had an average daily traffic (ADT) volume of 10,600 vehicles in 1988. This volume is projected to increase to over 14,000 vehicles per day by the year 2010.

The existing 2-lane overpass structure should be able to handle 14,000 VPD. For comparison the Orange Street bridge, which has a similar road section, currently passes 15,700 VPD and the Russell Street bridge, which has smaller 12-foot lanes, is carrying 19,500 VPD.

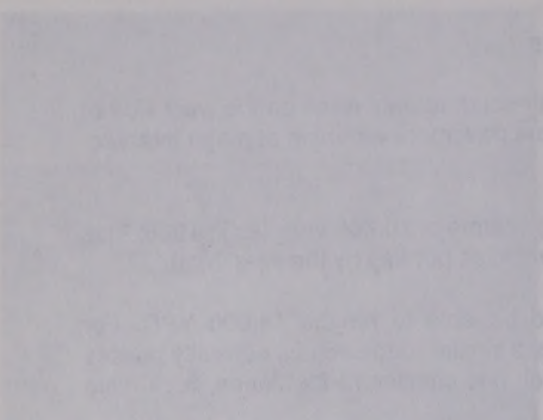
The access ramp configuration functions effectively. These ramp connectors should not have any problem carrying the future traffic volumes. The ramp intersections on West Broadway will require separate left and right turn lanes on the ramp approaches. Based on the projected traffic volumes, these intersections will likely meet the warrants for signalization by the year 2000.

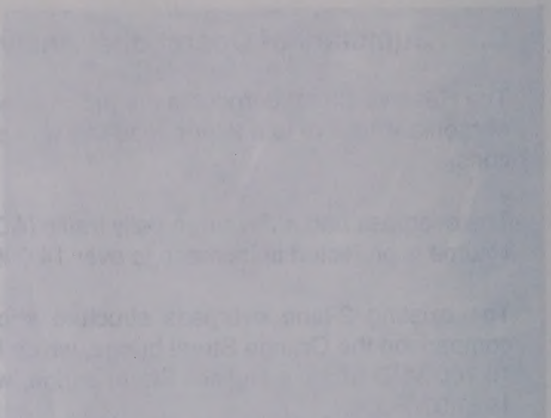
The southern portion of Reserve Street, from 3rd to Brooks, is scheduled to be widened to four lanes in 1991. As traffic increases, other sections of Reserve Street will eventually require four traffic lanes. The portion of Reserve Street south of the overpass, that carried 13,500 VPD in 1988, will carry 16,000 VPD by the year 2000. It is desirable to have a 4-lane road to carry that volume of traffic. The quality of travel on this corridor will depend on the level and type of roadside development that occurs.

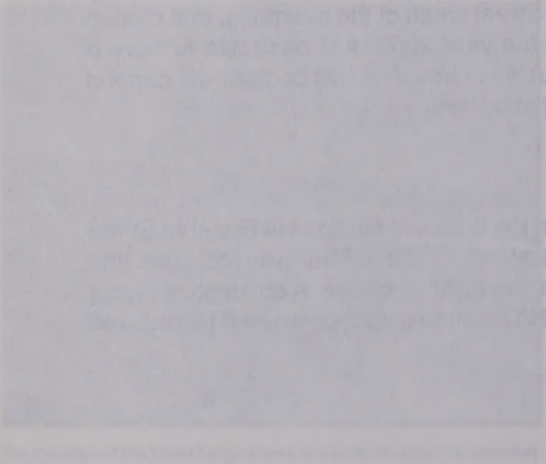
D. Alternatives Considered

The overpass should be widened to 4-lanes when the adjacent sections of Reserve Street are widened. The alignment of the existing roadway within the right-of-way indicates that the new structure would fit best on the east side of the existing bridge. A conceptual layout of the 4-lane overpass is shown in Figure No. 23. No additional right-of-way will be required for the new structure.

PHOTO PLATE NO. 8 - RESERVE STREET OVERPASS







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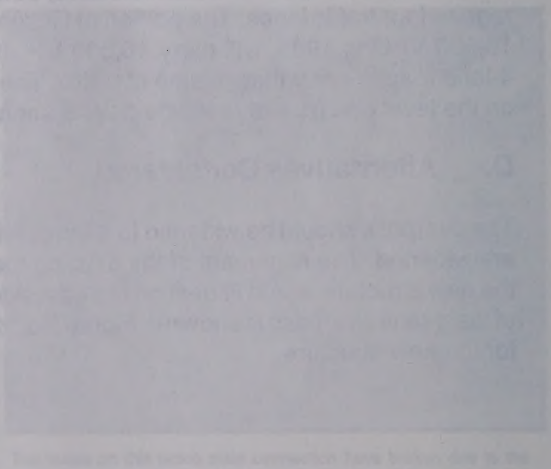
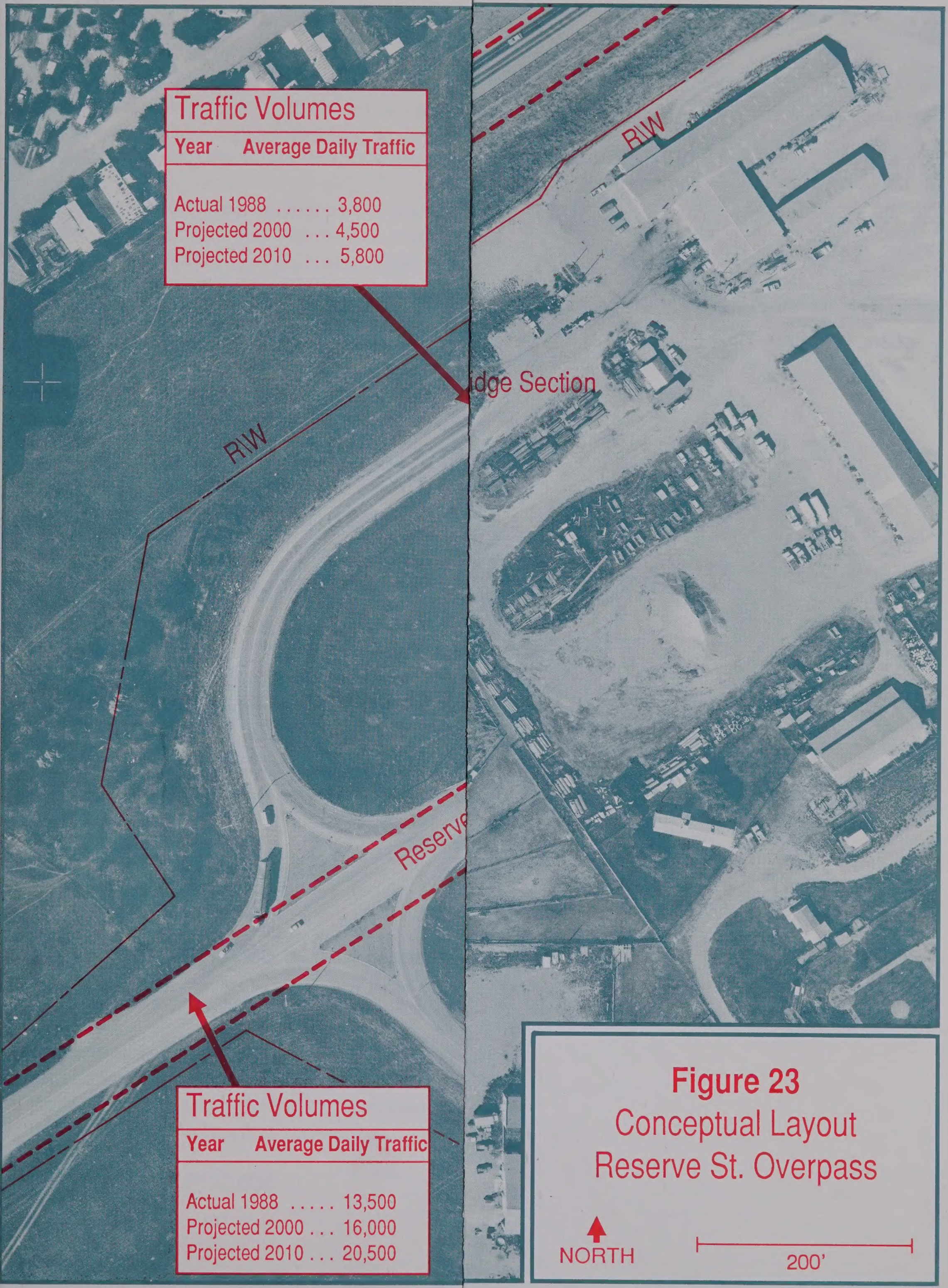


[illegible] connection have broken due to the [illegible] by the corrosion of the [illegible]


R/W
R/W
idge Section
Reserve
NORTH
200'

Traffic Volumes

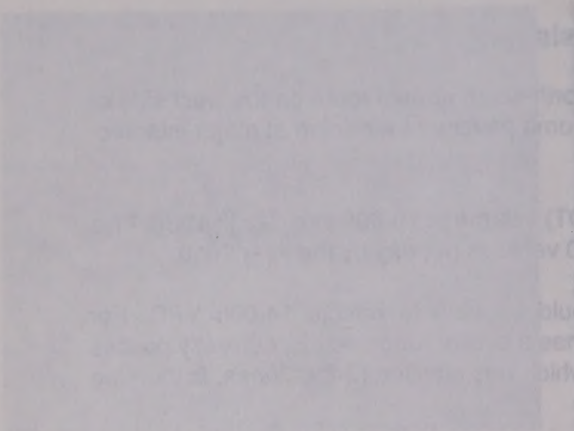
Year	Average Daily Traffic
Actual 1988	3,800
Projected 2000	4,500
Projected 2010	5,800

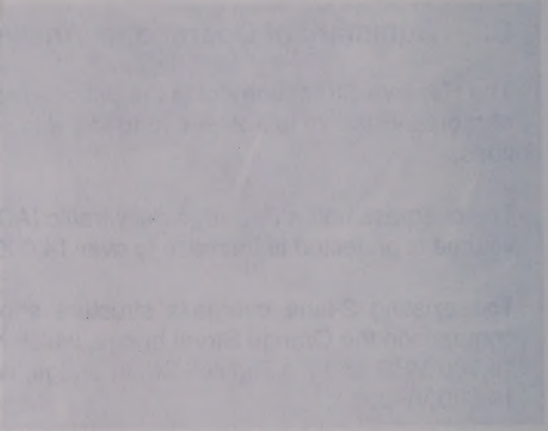
Traffic Volumes

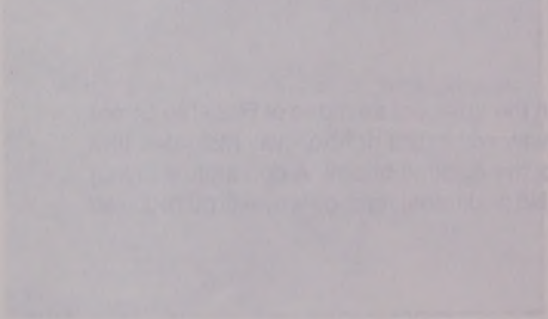
Year	Average Daily Traffic
Actual 1988	13,500
Projected 2000	16,000
Projected 2010	20,500

Figure 23
Conceptual Layout
Reserve St. Overpass

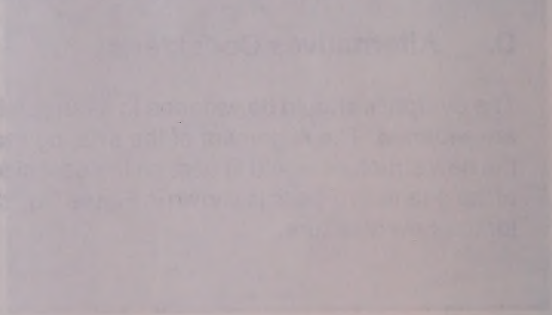
PHOTO PLATE NO. 8 - RESERVE STREET OVERPASS



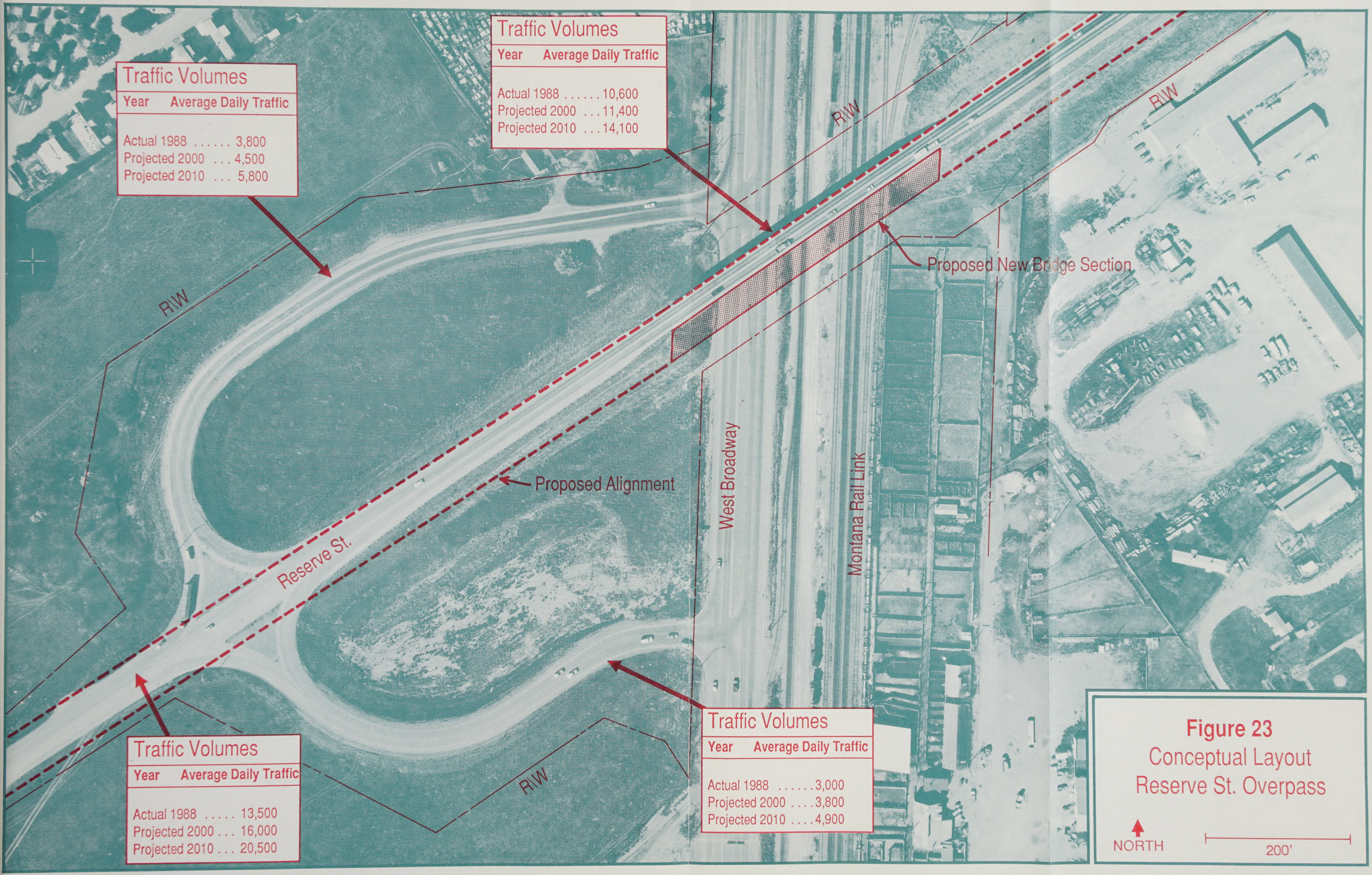




[illegible]



[illegible] by the corrosion of the [illegible]


R/W
R/W
R/W
R/W
Proposed New Bridge Section
Proposed Alignment
Reserve St.
West Broadway
Montana Rail Link
NORTH
200'

Traffic Volumes

Year	Average Daily Traffic
Actual 1988	3,800
Projected 2000	4,500
Projected 2010	5,800

Traffic Volumes

Year	Average Daily Traffic
Actual 1988	10,600
Projected 2000	11,400
Projected 2010	14,100

Traffic Volumes

Year	Average Daily Traffic
Actual 1988	13,500
Projected 2000	16,000
Projected 2010	20,500

Traffic Volumes

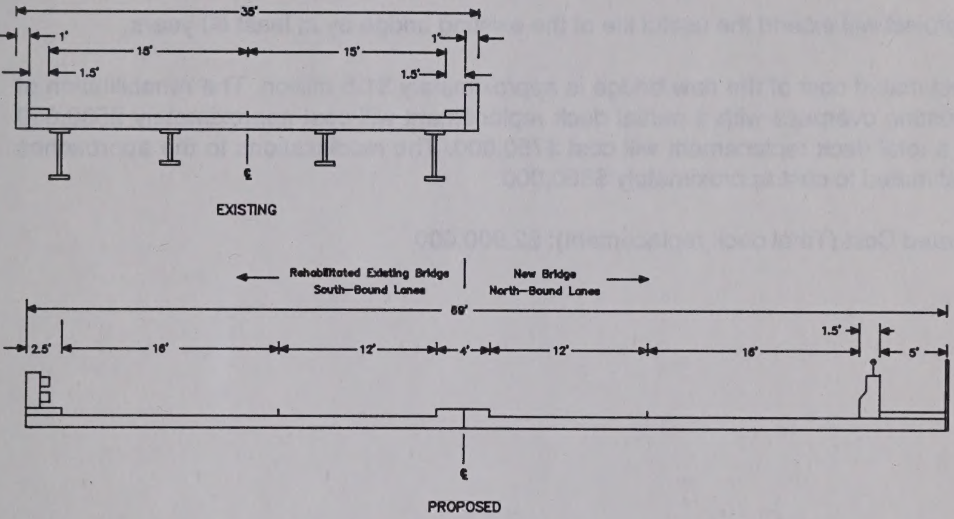
Year	Average Daily Traffic
Actual 1988	3,000
Projected 2000	3,800
Projected 2010	4,900

Figure 23
Conceptual Layout
Reserve St. Overpass

The remaining service life of the existing bridge deck will also control the timing of the bridge widening project. The overpass should be widened to four lanes before the existing deck requires major rehabilitation. The new bridge section could then be used to carry the traffic during the rehabilitation of the existing structure.

The proposed typical section of the new 4-lane overpass is shown in Figure No. 24. The typical section includes two 12-foot inside driving lanes, two 16-foot outside lanes, a 4-foot-wide concrete median and a single 5-foot-wide sidewalk.

Figure No. 24 - Proposed Typical Section - Reserve St. Overpass


35'
1'
15'
15'
1'
1.5'
1.5'
℄
EXISTING
Rehabilitated Existing Bridge
South-Bound Lanes
New Bridge
North-Bound Lanes
69'
2.5'
16'
12'
4'
12'
16'
1.5'
5'
℄
PROPOSED

E. Recommended Improvements

1. Repair and Maintenance of the Existing Overpass

Some modifications and heavy maintenance are recommended to reduce steel corrosion and concrete deterioration. This work should include providing water control at the bridge joints, grouting and patching the concrete supports, and cleaning and painting the steel members and the bearing assemblies.

Estimated Cost: $100,000

2. Widen Overpass to Four Lanes

The scheduling of the widening of this bridge will be controlled by one of two events. The bridge will require widening when the northern portion of Reserve Street is expanded to four lanes or when the existing bridge deck requires replacement, whichever comes first. The bridge widening should be done as a two phase project. Phase 1 should consist of the construction of a new bridge, located parallel and east of the existing bridge. This new structure should include two traffic lanes and a 5-foot sidewalk. Phase 2 should include a complete rehabilitation of the existing bridge. The amount of work required will depend on the condition of the structure at the time of the project. The bridge will need either a partial or total replacement of the concrete deck. Additional inspection and testing will be necessary to determine this once the project is scheduled. The work on the existing bridge should also include repainting all of the structural steel.

This project will extend the useful life of the existing bridge by at least 50 years.

The estimated cost of the new bridge is approximately $1.5 million. The rehabilitation of the existing overpass with a partial deck replacement will cost approximately $530,000 while a total deck replacement will cost $750,000. The modifications to the approaches are estimated to cost approximately $650,000.

Estimated Cost (Total deck replacement): $2,900,000

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